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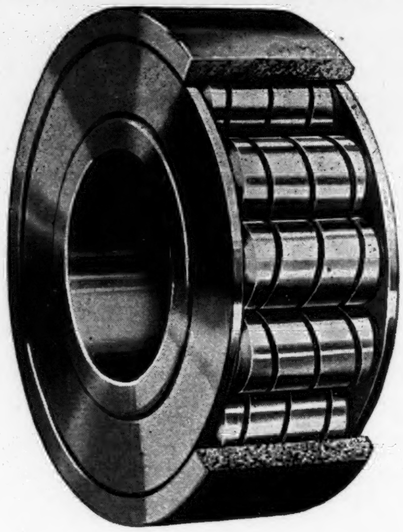


AGRICULTURAL ENGINEERING

The Journal of Engineering as Applied to Agriculture

Vol. 7 OCTOBER, 1926 No. 10

A National Program for Research in Mechanical Farm Equipment*

By J. Brownlee Davidson

Charter Mem. A.S.A.E. Senior Agricultural Engineer, Division of Agricultural Engineering, U. S. Department of Agriculture

ONE of the first topics considered by the joint Committee on Cooperative Relations of the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers, following its organization in 1924, was research and investigation. It was ascertained by this committee through a preliminary survey that, although research in agricultural engineering was an inviting field, the work in progress in the various agricultural experiment stations was very limited, particularly when compared with the programs of work in other subjects related to the development and progress of agriculture. A marked interest on the part of experiment station directors was shown, however, and many stated that if problems of promise could be furnished, additional investigational work in agricultural engineering could be taken up. On April 3, 1925, the committee passed resolutions relating to research and investigation as indicated in the following statement:

"Duly authorized representatives of the College Division of the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers, after careful investigation and consideration, adopted the following resolution:

"WHEREAS, The progress and development of American agriculture has been closely related to the utilization of labor saving equipment, and

"WHEREAS, Further progress for American agriculture and the maintenance of a desirable standard of living in rural life will depend upon the further extension and development of such equipment to insure profitable production, and

"WHEREAS, There is need for a coordinated program for the investigation of the efficient use of farm equipment, and

"WHEREAS, State experiment stations and other research agencies have indicated a desire to cooperate, and

"WHEREAS, There is an opportunity for increased efficiency and greater economy in the conduct of research and investigation, be it

"RESOLVED, That the Honorable The Secretary of Agriculture be requested to consider the possibility of the U. S. Department of Agriculture furnishing agricultural engineering research specialists, whose work shall be:

1. To survey the agricultural engineering research and investigation now in progress
2. To prepare and outline a comprehensive program of research and investigation in agricultural engineering
3. To furnish information to aid in planning and organizing research projects and to visit experimental stations for conferences when requested
4. To report frequently to all interested parties results and progress of research work in agricultural engineering
5. To furnish plans for the dissemination of information obtained from such research

"AND BE IT FURTHER RESOLVED, That the organization representatives pledge their assistance in carrying out such a program, if inaugurated."

These resolutions were presented in person to the Secretary of Agriculture, William M. Jardine, by a committee headed by Finley P. Mount, president of the National Association of Farm Equipment Manufacturers and Prof. H. B. Walker, president of the American Society of Agricultural Engineers. The Secretary was favorable to the suggestions contained in the resolution and arranged to have made such a survey of research and investigational work related to mechanical farm equipment. This survey was committed by the Secretary to the Division of Agricultural Engineering, Bureau of Public Roads, of which S. H. McCrory is chief. An advisory council to direct the survey was arranged for, consisting of eight representatives of the College Division, American Society of Agricultural Engineers, eight representatives of the National Association of Farm Equipment Manufacturers, and three representatives of the United States Department of Agriculture. The membership of the Advisory Council is as follows:

J. B. Davidson (Director), 832 Brookridge Ave., Ames, Iowa.
E. W. Allen, Chief, Office of Experiment Stations, U. S. D. A., Washington, D. C.
R. U. Blasingame, Pennsylvania State College, State College, Pennsylvania.
F. W. Duffee, University of Wisconsin, Madison, Wisconsin.
L. J. Fletcher, University of California, Davis, California.
G. W. Iverson, Advance-Rumely Thresher Co., La Porte, Indiana.
H. C. Lisle, Bean Spray Pump Co., Lansing, Michigan.
R. B. Lourie, John Deere Plow Co., Moline, Illinois.
Thos. H. MacDonald, Chief, Bureau of Public Roads, Washington, D. C.
S. H. McCrory, Chief, Div. of Agr. Engr., Bureau of Public Roads, Washington, D. C.
D. McDonald, Jr., B. F. Avery and Sons, Inc., Louisville, Kentucky.
J. C. Myers, The F. E. Myers & Bro. Co., Ashland, Ohio.
M. L. Nichols, Alabama Polytechnic Institute, Auburn, Alabama.
Dan Scoates, Texas A. & M. College, College Station, Texas.
Charles E. Seitz, Virginia Polytechnic Institute, Blacksburg, Virginia.
Oscar W. Sjogren, University of Nebraska, Lincoln, Nebraska.
H. B. Walker, Kansas State Agricultural College, Manhattan, Kansas.
W. L. Weintz, J. E. Porter Corporation, Ottawa, Illinois.
F. A. Wirt, J. I. Case Threshing Machine Co., 1606 Park Ave., Racine, Wisconsin.

*Paper presented at the 20th annual meeting of the American Society of Agricultural Engineers at Lake Tahoe, California, June, 1926.

"The policy of the experiment stations in the United States during their entire history, but particularly during the past twenty-five years, has been to secure definite information in regard to plant and animal life and to leave the program of applying this knowledge to productive agriculture almost entirely to the farmer. It is suggested that this attitude is largely responsible for the secondary position now occupied by agricultural engineering in the educational and research program. It may also be cited as one of the chief reasons why agricultural education has been almost wholly directed toward the training of young men for the professional phases of agriculture where little or no emphasis is placed on production—the principal purpose of the agricultural industry."

Arnold P. Yerkes, International Harvester Co., Chicago, Illinois.

The writer was selected as director of the survey and began active service January 1, 1926, giving full time to the work. A preliminary report was made to the Advisory Council at a meeting held in Chicago, February 16, 1926. At that meeting the present status of research and investigational work was reviewed and plans laid for the future.

Research Now in Progress. Robert W. Trullinger furnished the Council a list of research projects in progress at the state experiment stations. At the time of this meeting there were approximately 110 projects of a mechanical nature relating to equipment or power on record in the U.S.D.A. Office of Experiment Stations. Seventy-seven of these pertained to farm machinery. The number of power studies has recently been augmented by the addition of twenty-two projects relating to the application of electricity to agriculture. Two projects are reported under Adams funds and three under Purnell funds. Even with due allowance for the new electrical projects, there has been a marked increase in the number of projects during the past few years.

Suggested Research Problems. Inasmuch as the support of the two organizations was pledged to the survey, the Advisory Council thought it wise that the director should communicate with the membership of the American Society of Agricultural Engineers and that the chairman of the National Association of Farm Equipment Manufacturers' committee should request from the manufacturers suggestion of problems relating to mechanical farm equipment which should be solved. Practically all of the membership of the Society and a few manufacturers responded. Over eight hundred problems were suggested, furnishing a splendid cross-section of the views of our membership relative to needed research and investigation.

It is proposed that these suggestions shall form the basis of a report which shall have for its purpose the presentation of research and investigation in mechanical farm equipment as an inviting field of service. Although the details are not yet complete, it is contemplated to use the revised agricultural engineering classification for listing and classifying the problems and interposing in some suitable manner the work now in progress. Among the eight hundred suggestions there are many duplicates and a number of suggestions which in fact do not constitute problems which can be listed.

Analysis of Problems Suggested. It is interesting to study the suggestions offered for the purpose of classifying the problems or for determining the viewpoint of those proposing the problems. Such a study cannot help but convince one that the statement of a research problem requires a certain attitude of mind representing discontent with present conditions and a vision of new situations, coupled with a practical and personal knowledge of the processes involved. The problems suggested can be classified easily and placed in three groups.

The first group of problems relates to farm practice, and questions the scientific correctness of present practice. Those who have proposed the problems which may be included in this group hold to the premise that farm practice is largely a matter of habit and tradition from which we have never undertaken to free ourselves. For instance, considering the preparation of the seedbed, an important matter in crop production, it has not been determined that the present practice is best. Is the plow the best implement for the first operation and do the subsequent operations with other tillage machines give the best and most economic results? No less authority than Sir John Russell has recently said that "we cannot say with assurance that we ought to plow." Many agricultural scientists have the same attitude but do not have the opportunity to make an advance without the service of the engineer. This skeptical attitude toward present farm practice is maintained toward all the operations involved in agriculture and is the source of a large list of problems involving the production and care of agricultural crops.

The second large group of problems involves the efficiency and economy of farm practice. It appears that those responsible for these problems are inclined to assume the attitude that present practice is about correct, that experience gained through the centuries has been a good teacher, but question the efficiency or economy with which these operations are performed. If an analysis be made of the cost of producing any agricultural crop, it is easy to point out that labor and power are two of the largest items. Since it is with these factors that the engineer is trained to deal, it appears as an invited point of attack. In the production of the principal crops in the United States, labor and power make up from forty to seventy per cent of the total cost. Furthermore, the other items are largely fixed items which the individual farmer cannot readily change. Even a cursory survey of farm practice from this viewpoint indicates that present practice varies through a very wide range. C. D. Kinsman, of the U.S.D.A., reported two years ago that farmers were using, according to their own reports, from three to three hundred hours to produce an acre of corn.

The third group of problems comprises miscellaneous and sundry problems largely engineering in character, involving machine design or efficiency. These problems are based largely on a previous determination of the essentials or requirements of farm practice. Mechanical analysis, machine efficiencies, durability, economy, and safety of all kinds of farm equipment make up this group of problems.

Cooperation. It is to be pointed out that the solution of the first two groups of problems involves cooperation, as the problems require much more than engineering. It has been represented to the experiment station directors that the farm equipment industry is interested in a determination of the principles, the essentials, and the requirements of farm practice upon which to base the design of farm machines. However, the engineer occupies a very important place in the conduct of investigations of this character, as experiments with equipment should at least require the services of a specialist trained and experienced in the operation of the equipment used. It might appear, from the past experience, that one reason for the delay of research in this field may be due to inability

to secure effective cooperation from all parties concerned.

Special emphasis has been placed upon basic or fundamental research by those administering research funds during the past few years. It is to be pointed out that the first group of problems is made up entirely of such problems and the second group ought to be quite satisfying.

Visits to experiment stations. The Advisory Council thought it wise that the Director of the Survey should visit the state agricultural experiment stations for conference with the agricultural engineering staff and the director of the experiment station. To date, thirty-six stations have been visited. Some general observations made in conection with the visits may be of interest. Everywhere the Director was received with utmost courtesy, even where little or no emphasis is being placed on agricultural engineering, and everywhere there seemed at least general interest in this field.

The matter of cooperation between station departments seems to be a matter of interest to station directors and the proposal that the agricultural engineer needed the cooperation of other scientists in connection with many of its fundamental problems was well received. It is evident from the statements made by the director that there has been too much independence or autonomy given to individual departments with emphasis on the specialist rather than upon the problem involved. Only at one place in my visit was the suggestion of cooperation criticised. One worker stated that there was too much cooperation at present; that what was needed was the opportunity for the individual to devote his energy to a problem without interference. Personally, I think this a very short-sighted view when so much efficiency it to be gained by cooperation. At one place I found an engineer making gas analysis which, it would appear, could be done better by a chemist with a saving of time and equipment. The past may have justified individual effort, but the present demands that workers in all branches of science should correlate their efforts. Research workers should not be isolated individuals but parts of an efficient, cooperating organization.

Appreciation of agricultural engineering. There is a general lack of appreciation of the service of the engineer. Taking into account notable exceptions, few agricultural administrators have the engineer's conception of agriculture and the relation of engineering to the industry. For the most part these administrators are men trained in agricultural sciences quite removed from production. The engineer's view of agriculture as the production of food and raw materials for shelter and clothing with the special influence that productive capacity will have on the welfare of the individual farm worker is not generally appreciated. It would appear that it would be worth while to undertake to make this viewpoint, this ideal, clearer to those with whom we work.

Objectives. In the discussion of agricultural enginering research, the question of the main objectives of agricultural education and research was quite sure to rise in the background. It is an impression that objectives are not any too education and research was quite sure to rise in the back-well-defined and such objectives as "more production" and "more economic" production are the central thoughts of certain agricultural leaders. However, there seems to be a general crystallization of thought upon the objective of better living on the farms. The relation of agricultural engineering to this objective or ideal is very clear because, with desire for better living, engineering methods increase individual income necessary to secure better living. A formula has been found useful in presenting this viewpoint. It is as follows:

$I = (S - C)\,Q$ where

I = net income

S = selling price per unit, of agricultural commodities produced

C = cost of producing the same per unit

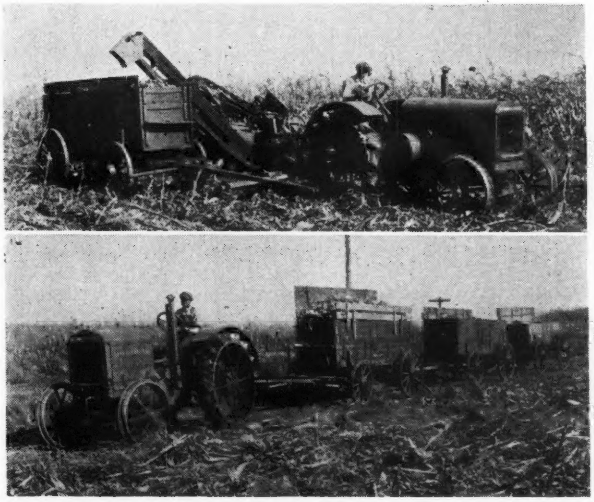
Q = quantity of agricultural commodity produced

It would appear that too little emphasis is placed upon Q in the average program of service to agriculture.

Project statements. It seems that one of the obstacles in the development of a research program is the lack of good definite project statements. Several directors stated that they were prepared to start investigational work as soon as they were furnished with project statements having definite or specific objectives or well-outlined methods of procedure. Perhaps no greater service could be rendered research in agricultural engineering than to render cooperative assistance in this matter. It is evident that a ready-made project statement handed to the worker is quite unsatisfactory because a full and complete understanding of the problem and its purpose is essential, but on the other hand a good model or pattern will be particularly helpful. A research manual giving advice and instructions for the organization, the preparation of statements, and the reporting of experimental projects would be of great assistance.

Graduate instruction. The conduct of fruitful research requires a certain type of worker. Not all men are endowed by nature with the essential characteristics of an investigator, and perhaps that is well because certain other individuals are needed to utilize present knowledge to the advantage of society. However, the success of research depends to a large extent upon training. Methods of conducting investigation have most to do with the efficiency and economy of the work. Since this is true, graduate work which gives the student a taste of research with an opportunity to determine whether or not he may want to continue it is quite essential to the progress and development of agricultural engineering research. Although not now a part of the present program, graduate instruction in agricultural enginering should be given careful attention. It would seem that there is some criticism of the

The power take-off, which Prof. Davidson says should not have taken fifteen years in arriving, is largely responsible for the gratifying, though long-delayed, acceptance of the mechanical corn picker. Moreover, it did not originate through widespread farmer demand nor from sales department pressure. Long ago the voice of the engineer crying in the wilderness bewailed the absurdity of laying down power on a slippery soil with a drivewheel and then picking it up from the same soil with a bullwheel. With the outfit shown one man harvests ten or eleven acres of corn a day, multiplying his capacity by six.



"To date the agricultural education and research program has contributed little toward progress in farm practice as it relates to the actual work of production. We have made wonderful advance in the past three-quarters of a century, but in general this has been accomplished by farmers who have offered the suggestions of improved devices and by manufacturers who have refined and developed the ideas into machines."

graduate work as now conducted and this in itself demands careful consideration.

Bibliography. In connection with the present survey, the division of agricultural engineering, Bureau of Roads, U. S. Department of Agriculture, is preparing a bibliography pertaining to mechanical farm equipment. It is planned to make this bibliography quite complete and if published should be a valuable contribution to the furtherance of research in this field.

Applied science. It would appear from a study of the past and present conditions that the policy of the experiment stations in the United States during their entire history, but particularly during the past twenty-five years, has been to secure definite information in regard to plant and animal life and to leave the program of applying this knowledge to productive agriculture almost entirely to the farmer. It is suggested that this attitude is largely responsible for the secondary position now occupied by agricultural engineering in the educational and research program. It may also be cited as one of the chief reasons why agricultural education has been almost wholly directed toward the training of young men for the professional phases of agriculture where little or no emphasis is placed on production—the principal purpose of the agricultural industry.

It may be stated with considerable exactness that to date the agricultural education and research program has contributed little toward progress in farm practice as far as it relates to actually doing the work of production. True it is we have made wonderful advance in the past three-quarters of the century, but in general this has been accomplished, first, by farmers who have offered the suggestions of improved devices and, second, by manufacturers who have refined and developed the ideas into machines which could be manufactured and furnished the farmers.

There is much evidence that this situation is appreciated by many agricultural workers who are longing for opportunity for leadership to be displayed in productive agriculture. The management and operation of farms as now conducted by many agricultural engineering departments in the agricultural colleges is a distinct advance step toward vitalizing and establishing agricultural engineering in the institution. It does not appear that such an activity interferes, but rather enriches the instructional work of the departments and will no doubt prepare the proper relationship for investigational work. Agricultural economics or farm management occupies much the same position as agricultural engineering and it is interesting that specialists in this field are becoming restive and are seeking a method of coordinating theory and practice. The common needs of these two lines of work should furnish a splendid opportunity for cooperative effort. In several institutions much of the work formerly designated as farm management is being transferred to agricultural engineering and more emphasis placed upon economics, but in any case the division in the field should not be allowed to be an obstacle.

The interest of the farm equipment industry. It is very evident that a program of research is of particular concern to the farm equipment industry. The present survey has been possible largely on account of the interest of that industry. It is right and proper that the industry shall expect the state and federal experiment station work to furnish the essential principles or requirements of farm production upon which to base the design of equipment. Too often the industry and the public investigators have not appreciated their mutual interests. It would seem that in the present program there is a clearer understanding of the responsibility of each party than ever before. It is not the purpose of the public program to design machines, but furnish the data for design. That certain machines will be developed as by-products is quite certain, but this shall not be the main objective.

If agricultural education and research as supported by public funds have not been effective in attaining leadership in the progress of farm practice, the farm equipment industry has some hindrances to leadership of a somewhat different character. As now constituted, the industry has unusually efficient facilities for refining and developing machines now in use, but on the other hand there is a very definite obstacle to revolutionary methods. The primary objective in the industry is undoubtedly the manufacture of farm machines which may be sold at a profit. The industry has, in the writer's judgment, the highest commercial ideals anywhere to be found and service is the guiding principle. Yet it is clear that a change of farm practice involving new machines of a radical character would be not only expensive but quite suicidal for any one firm to undertake.

If you doubt the soundness of this view, point if you will to the new machines which have been produced during the past twenty-five years. Development has been largely confined to the machines themselves with an increase in their size in many instances. The tractor development of the past twenty years has been mainly that of producing a mechanical horse having wheels instead of legs. It should not have required fifteen years to produce a power take-off or twenty-five years to determine the practicability of the combined harvester-thresher east of the Rockies. That the industry has sales department control is not the fault of the industry or the men in the industry but the result of circumstances. A national research program relating to farm equipment must take into account the interests of the farm equipment industry, for without this recognition it is quite sure to fail. A study of this situation in pertinent.

Testing of machines. It is rather significant that very little testing of farm machines primarily to determine which make of machine is the best has been proposed. Machine testing has been popular in Europe and in the past has been mentioned frequently in the United States. Perhaps the new viewpoint is evidence of an advance in our attitude toward research in this field. It seems logical that any very definite program for the testing of a machine to determine its merits would necessitate that the requirements of the operations involved should first be determined. When these requirements are definitely specified, the comparison of the performance of a machine with these requirements will be comparatively easy.

The national program. The purpose of the movement described in this paper is to prepare such an inviting picture of the opportunity for service through research and investigation in mechanical farm equipment that a national cooperative program will grow out of it. On the success of such program will depend the future status of the American farmer. There seems to be no insurmountable obstacle to this program. To make it a success there must be careful planning, cooperation and hard work. May future history record its success.

EDITOR'S NOTE: Prof. Davidson's leave of absence from Iowa State College having expired, he has returned to his duties there as head of the department of agricultural engineering. It is expected, however, that the work described in his paper will be continued by the division of agricultural engineering of the Bureau of Public Roads, U. S. Department of Agriculture. So far as is now known there will continue to be an advisory council consisting of representatives of the American Society of Agricultural Engineers and the National Association of Farm Equipment Manufacturers.

Progressive Construction of Farm Homes*

By Max E. Cook

Mem. A.S.A.E. Farmstead Engineer, California Redwood Association

PROGRESSIVE construction is not new to the farmer, nor is the unit system of building less known to him than to builders elsewhere. Modifications in the initial layout and additions to the original structures are often found desirable. The farmer everywhere develops and improves his farm by successive stages; some with results more truly progressive than others.

As a builder he neither receives the recognition to which he is entitled, nor enjoys anything like the helpful guidance and cooperation of kindred interests available to builders in other fields. As a consequence, we have wasteful methods of construction, unwise and uneconomical selection and use of materials, lack of convenience, low efficiency, expensive upkeep, extravagant remodeling costs, unattractive surroundings, and poor living and housing conditions as compared with urban development.

With an average of seven and one-half buildings on six and one-half billion farms, such buildings deserve careful and intelligent planning, and it is of equal importance to plan the relationship of these buildings on each individual farmstead. Before undertaking to build, all probable future housing requirements should be fully listed and given due consideration along with the present essentials. Without carefully planning to permit of future expansion, or possible changes in duty, or alternate uses, buildings are rapidly outgrown, become inefficient or completely obsolete.

The problem of providing adequate housing yields not alone to dollars and cents, but is as often solved by simple forethought. True enough, a budget must be adopted and followed, but the amount of ready capital available certainly should not govern the ultimate size or layout. The fact that the farmer's capital is limited, either in establishing himself on a new farm, or in making improvements on an existing one, does not justify his proceeding without a comprehensive plan. It makes it all the more necessary to have one.

The poorly planned building or house of bargain materials, adopted because it appears to be the "most for the money," is a poor investment. Quality is too often sacrificed, while rooms and floor areas are held down to a bare minimum and arrangement is inflexible. In the later addition of a needed porch, or an extra room or two that are sure to follow, the modest little house with the "Queen Anne" front soon acquires a "Mary Ann" back.

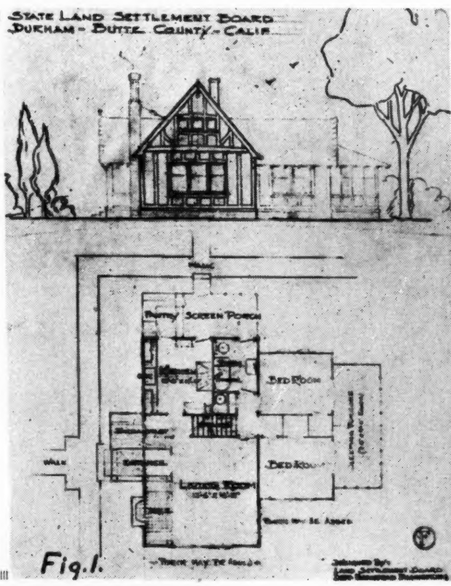
These contingencies are all met successfully by the adoption first of a systematic and orderly plan of procedure. There are three distinct methods by which successful results are obtained progressively without sacrifice of quality or appearance where immediately available funds are limited.

The Unit System. The unit system of planning and building makes possible many variations in size and layout to meet individual requirements. The principles apply alike in making new improvements on an established farm, or in the development of new farms, either with buildings alone or in the farmstead layout itself. Buildings are designed and laid out as dictated by ultimate requirements, but in such form as to make it possible to build in units to meet only the preliminary needs. Provision is made to avoid waste in making later additions and by anticipating maximum salvage possibilities where actual changes are necessary.

The units as they are developed are complete in every sense and at least that unit or portion of a building that is built is enjoyed to the limit, containing as it does all the features of convenience, equipment and finish, individually desired. (See Figs. 1 and 2.)

Shell or Skeleton System. Obviously, building on the unit plan is not satisfactory where there is a definite requirement for greater area or larger floor spaces. To obtain the maximum amount of permanent housing at the lowest possible cost, there is but one road open. It becomes necessary to eliminate the non-essentials, omitting only those things that can be added later with the least inconvenience, and without sacrifice to a good foundation, honest frame, solid construction, and durable walls and roof. In other words, build the shell or skeleton of a building, but let it be the nucleus of a better building—a permanent improvement. An advantage that this method has over the unit system is that there is less tendency to depart from the original plan. Furthermore,

*Paper presented at the 20th annual meeting of the A.S.A.E., June, 1926, at Lake Tahoe, California.



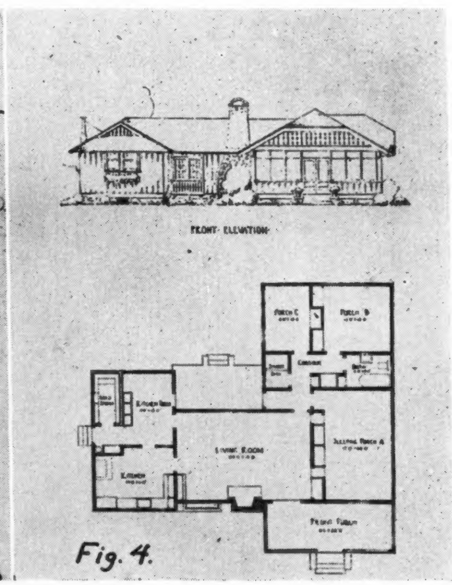


Fig. 1. A house planned and built on the unit system. The original portion is shown in heavier lines, and the units to be added later, as funds permit, in lighter lines

Fig. 4. A farm house built originally without complete equipment. This design also lends itself to unit construction

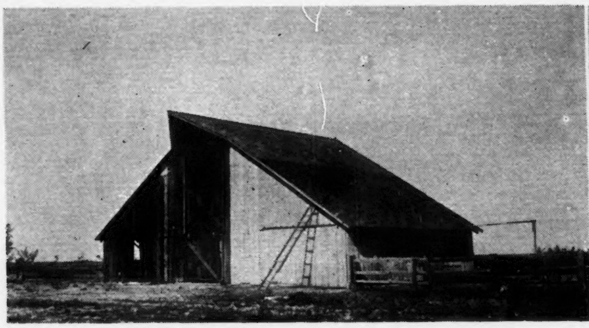


Fig. 2. (Left) The shed wing in the foreground served as an all-purpose barn for more than a year. In completing the barn the boards from the high side of the wing were utilized without waste. Fig. 3. (Right) Here is a combination of the unit and shell systems. The garage wing is a year older than the rest. A unit yet to be built at the front of the house is in the form of a pergola with trellis extending across the front and back to the side entrance

the exterior surroundings are undisturbed by later developments. (See Figs. 3 and 4.)

Dual-Purpose Structures. Where there are insufficient funds to permit of building, according to recognized standards, either a finished unit of a permanent structure, or a good building honestly built that may yet be incomplete as to full equipment, finish, etc., it is sometimes found desirable to erect a building to be occupied temporarily for a given use with a plan for conversion later to meet a future requirement.

Such a building, carefully and thoughtfully designed, can be made to serve very satisfactorily as a temporary dwelling and as such can have many conveniences and be made very livable with considerably less invested than is possible by any other means. All special equipment, such as sash, doors, screens, hardware, trim, etc., are selected of design and type suitable for the more elaborate structure to follow. They are incorporated temporarily in such a way as to be readily removable and are thus recovered later without damage or unnecessary expense. (See Figs. 5 and 6.)

Progressive building is merely another way of building on the installment plan. No one method can be considered best while the human element is involved. Obviously, one without real ambition and firmness of purpose should not be encouraged to build a temporary dwelling if there remains any doubt as to his ability to carry on to the development of a better home later. The same obtains, although perhaps to a lesser degree, with the other two methods outlined.

We are fully aware that while each farmer's building problem is an individual one, he cannot afford direct professional services to assist him, nor can he be successful farmer, agricultural engineer, architect and master-builder alike.

Although 95 per cent of all farm buildings are constructed of lumber, there yet remain untouched possibilities in planning farm structures that permit the utilization of economical lengths and stock sizes of species and grades most suitable.

Hand in hand with any educational effort that is undertaken to promote better farm buildings should go a decidedly closer working relationship with the retail lumber dealer. To keep pace with modern merchandising methods he is fast converting his former "lumber yard" into a complete building material supply house, in many instances supplemented with a free plan service. His importance in most farming communities as a "father advisor" on all building matters is too often ignored or overlooked. He merits recognition as one of our strongest allies in the better farm building movement.

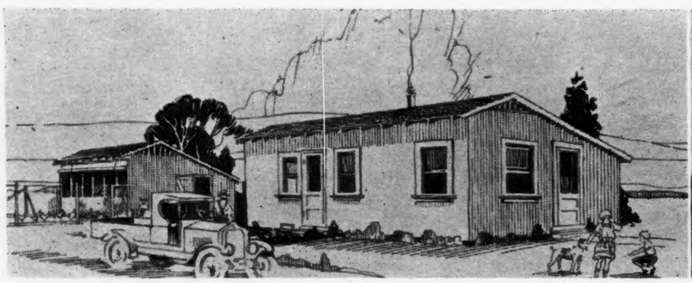
EDITOR'S NOTE: The author was for six years in charge of building work for the California State Land Settlement Board, and this paper, especially the illustrations, is based largely on the buildings on the California state land colonies.

Industrial Safety Codes Approved by A.E.S.C.

THE approval of several important industrial safety codes is announced by the American Engineering Standards Committee. These form part of a comprehensive group of sixty such codes which during the last seven years have engaged the attention, not only of the Committtee, but of more than a hundred national organizations which have been officially cooperating in the development of this safety code program. More than a third of the group of sixty codes has now been completed and approved.

A typical example of this effort is the regulations for the prevention of fire and explosions in dusty industries, the preparation of which the National Fire Protection Association has been working on several years. Some time ago this work was brought under the procedure of the A.E.S.C., the work being broadened and the committee being enlarged by increase representation into a regular sectional committee under the joint sponsorship of the N.F.P.A. and the U. S. Department of Agriculture. Special codes for the prevention of explosions in pulverized fuel systems, in terminal grain elevators, in flour and feed mills, in sugar mills, cocoa mills, and starch factories were reviewed by the enlarged sectional committee and have now been approved by the sponsors and by the A.E.S.C. This includes revisions of some of the special codes.

It is confidently believed that as the use of these codes is extended to cover all of the industries affected, disasters from dust explosions will be practically eliminated.



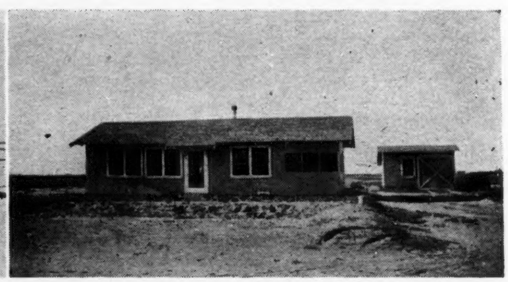


Fig. 5. (Left) A temporary dwelling designed to be converted later into a poultry house. The doors, windows, screens, etc., are readily salvaged for use in the permanent home. Fig. 6. (Right) A temporary dwelling of five rooms to be converted later into a shop and implement shed. The temporary garage will become the first unit of a poultry house

Rural Electrification from an Economic and Engineering Standpoint*

By L. S. Wing

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AT THE inception of the electric industry some forty-four years ago, its promoters were obliged under the then competitive conditions to develop such loads as promised the greatest profits; the struggle was for survival and failures were many. Today under public regulation this condition no longer exists. The central station industry is regarded as one of the safest of investments; it is one of the few that can boast of never having experienced a reduction in its gross revenue. The industry is firmly established; it operates as a monoply, generally under state control, and as such it owes a duty to the whole territory, both urban and rural, in which it is located and not to certain especially profitable sections which selfish interests might dictate as being the reasonable confines of its service area.

This comment should not be interpreted as meaning that the farmer is to be subsidized by the state, the utility which serves him, or its present consumers. It does imply that further reduction in existing urban rates may, in some cases, have to be postponed in order that the utility may pioneer rural lines; also, that the utility forego what might be termed a full return upon its rural investment during the development stage of that business. The farmer must be served from the start at rates he can afford to pay, and which make further use of this power attractive. Rates based on eight and ten per cent return upon the investment from the start, with full pro rata allocation of all operating costs and fixed charges, will only serve to stifle development. The rural load must pay its share eventually, but it cannot be expected to spring fully matured and developed from the seed—no other class of load served by the electrical industry has been fully profitable from its inception.

To anyone studying the problem of rural electrification for the first time, three questions might naturally occur:

1. What factors in the past have influenced electrical rates and the extension of service to new loads?
2. What forms of rural rates and extension policies have been used, and with what success?
3. What are the factors to consider in determining the amount and form of rates and the terms of an extension policy?

The history of the industry shows that in the beginning the load consisted of light exclusively, operation was for a few hours at night only, and both because of this and the extremely small scale on which operations were conducted the relation of energy output to overhead investment and operation costs was very low and rates were of necessity, even under cutthroat competition, very high. The development of the electric motor and its application to industrial and railway uses greatly reduced the average cost of production.

As industrial loads involved competition with other forms of power, it was necessary to sell at a competitive rate, much lower than the prevailing lighting rate. The importance of this development was to establish the fact that the result of this apparent discrimination against the lighting consumer actually has been to effect such enormous economy in operation and in the division of overhead expense as to bring about continuous reduction in lighting rates, the average price falling gradually from twenty cents per kilowatt-hour in 1883 to seven and one-half cents in 1925. Taking into account the depreciation of the dollar, the reduction is even more marked. A very large part of the utility's investment, particularly in transmission and distribution lines, consists of items whose cost is influenced little or none by the amount of energy being handled, consequently, the rates which must bear these investment costs are very largely influenced by the volume of energy production.

Other parts of the utility's investment, notably the generating equipment, are controlled by the peak load or maximum demand, and this cost also must be spread over the amount of energy sold. Consequently, one of the most important points in utility management, if rates are to be reasonably low, is to develop off-peak types of loads which will not necessitate increases in plant investment, but which will enable the system to operate at the highest possible percentage of total capacity, thereby spreading this element of cost over as large a production as possible.

Reference is made to high lights in the history of rate making represented by the papers of Dr. John Hopkinson in 1892, W. J. Greene in 1896, Arthur Wright in the same year, and Henry L. Doherty in 1900. Out of the substance of these papers has developed the generally accepted and apparently sound doctrine that any electric energy rate properly lies between two limits: It cannot go above what the traffic will bear and it should not be served at less than "out-of-pocket cost," the former being defined as the price which the user can afford to pay and which will produce the greatest returns to the seller above expenses incurred, while the latter term may be defined as the additional cost to a going concern of serving a new class of load.

From these considerations as premises it is apparent that the distribution of electric energy to rural customers over the long transmission and distribution lines necessary can not be done at reasonable cost unless the cost is spread over a larger amount of energy than is represented by ordinary family use for lighting and small household appliances, even though these be somewhat greater for the farm than for the city family. In other words, the supplying of electric energy to farm consumers at an economical rate is contingent on the development of the equivalent of an industrial load, which might perhaps be designated as an agricultural load in its proper sense.

It is pointed out that contrary to usual belief the use of electricity in agriculture is not new, but is almost as old as the industry, although such agricultural use has been so limited, territorially and in total amount, as to be obscured by the enormous expansion of the electric industry as a whole. The evolution of rates for agricultural electric power is reviewed in some details and the defects of the various methods which have been tried pointed out, it being shown that while no method is ideal, the discriminations and other objectionable features have been very largely reduced. This experience with the various rate forms, together with economic considerations, lead to certain conclusions as to rate schedules for agricultural power purposes, most of which are applicable to this form of service anywhere, but some of which apply only to the sale of energy for power uses in the West. These conclusions are:

1. The company should own and maintain all facilities for rendering service.
2. Where a large part of the energy generated by the company is produced in hydroelectric plants, the rate for power during the spring run-off should be low.
3. The major portion of the annual charges should be collected in the months of maximum use.
4. Rates for each size of installation should follow, as nearly as practicable, the cost of service, but the schedule should contain sufficient differential in cost due to size of installations as to discourage the use of larger motors than required.
5. Each consumer should pay at least the cost of service directly incurred in serving him.
6. The rate must be low enough to meet the competition of other kinds of available power.
7. The rate for energy, aside from "readiness to serve"

*Abstract of a paper presented before the 20th annual meeting of the American Society of Agricultural Engineers at Lake Tahoe, California, June, 1926. The complete paper will be published in full in the 1926 A.S.A.E. Transactions.

So wide has been the attention and so marked the consideration given by the electrical fraternity to the paper here abstracted that it promises to become a landmark in the economics of rural electrification and the technique of rural rate-making. It is a notable example of agricultural engineering.

charge, should be as low as the total cost of serving will permit.

8. The rate schedule should be simple.

9. The rate schedule should collect charges on an annual basis, and permit use of plant at consumer's option.

10. The rate schedule should be applicable to all classes of farm power service.

11. Only one rate schedule should apply to the service used.

12. Charges made under the rate schedule should be based upon factors directly within the consumer's control.

In the territory chiefly contemplated by this paper, the prevailing type of rate for domestic service where cooking and heating are involved, in both urban and rural areas, is what is known as the combination rate, and it is found a satisfactory method. It has the special advantage of permitting the entire household consumption to be taken through one meter. It is what is known as a blocked meter rate, consisting of a rather low minimum charge, a first block of kilowatt-hours at a rather high rate, followed by a second block at a lower rate, and a third block at an extremely low rate. It is found that in practice such an arrangement approximates the supposition that the first block covers lighting and small appliances, the next block cooking and electric refrigeration, and the final block the operation of electric brooders, incubators, and general farm power applications, it being permissable under this rate to employ motors, single-phase, up to 5 horsepower.

One of the most perplexing and at the same time one of the most important problems in connection with rural electrification is the policy with respect to line extension. A review and analysis of experience in such extension leads to the conclusion that the chief requirements of an extension contract are:

1. It should be short, simple, and easily understood.

2. The company's investment should be based on factors readily understood by the consumer and within his control: viz: The amount of company's expenditure should depend upon the size and character of consumer's installation.

3. The guarantee to take service should not extend beyond a five-year period.

4. It should contain a statement that the rates charged are subject to change at the discretion of the regulatory body.

5. Refunds should be made on the basis of all business added to the line; also a certain percentage of consumer's bills should be refunded.

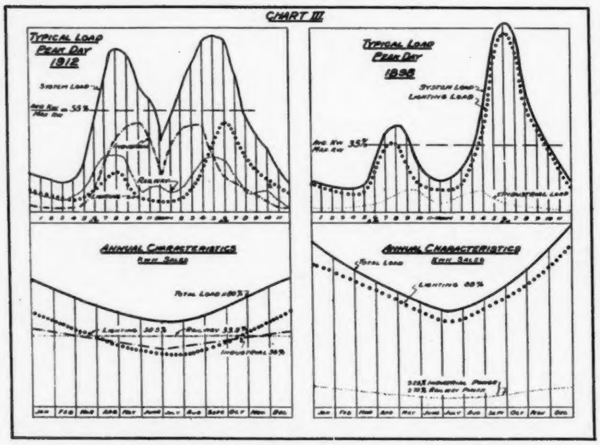
It is pointed out that the rate for power and the extension rule are closely allied, one being derived from the other, but in presenting them to the farmer they should be kept entirely separate. Every farmer should be on the same rate schedule regardless of any advance required of him to get service, or investment made by the company. He will likely forget any different amount advanced to get service than did his neighbor, but if made part of the rate, it is a perpetual reminder and he is apt to become dissatisfied.

Another important point in relation to depreciation, which plays a large part in cost and rate, is that the life of equipment in rural districts is longer than in congested urban sections. In the state of California an allowance of two per cent for all rural equipment is ample. Maintenance of distribution lines, exclusive of transformers, services, and meters, averages about fifty dollars a mile.

From the standpoint of seasonal load distribution, an agricultural load is desirable, at least under California conditions, because the periods of heaviest current consumption come during the spring and summer months, tending to hold up the load factor which ordinarily is in a slump due to the falling off in the industrial uses of electric power at that season of the year. To the extent that this additional load can be handled without increase in equipment for generating and transmitting power, it is the sort of business which may legitimately be encouraged by a low rate.

It further is pointed out that because of the pioneering nature of rural electrification, rural consumers will not be able to pay more than the out-of-pocket cost of service for several years. There are, though, many instances where this load can be served without a loss to the utility or its other consumers, yet at rates which the farmer can afford to pay.

EDITOR'S NOTE: The original paper also contains a section on allocation of costs and derivation of rates which, while important, is too complicated to take up within the space limitations of this abstract. This section, and in fact the entire paper, is supplemented by graphs, of which only two, Charts III and IV, are reproduced here.



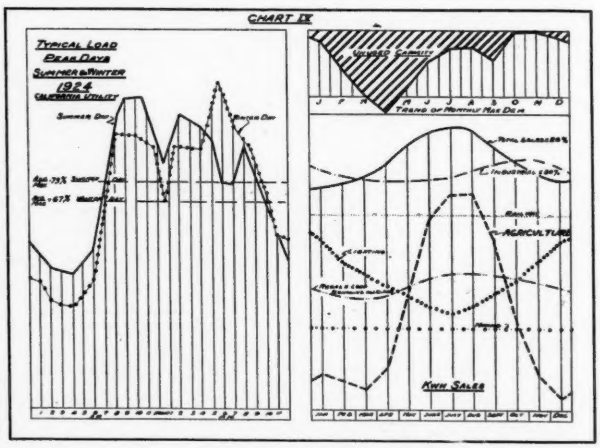


Chart III. (Left) Typical load curves illustrating the subsequent effect upon power costs resulting from supplying railway and diversified industrial loads. Chart IV. (Right) The present daily load curve of one of California's largest utilities

As German Scientists See Us

IN 1924 and 1925 a commission of scientists from Germany spent nine months in the United States and Canada studying our agriculture. Members of the American Society of Agricultural Engineers will find much of interest in the reports presented orally before the Deutsche Landwirtschaftliche Gesellschaft and published in a special reprint of the journal of the Gesellschaft. (Mitteilungen der Deutsche Landwirtschaftliche Gesellschaft, special reprint from Nos. 15, 16, 17 and 19, 1926.) Many members of A.S.A.E. will not concur in some of the opinions expressed by these gentlemen, though all must admire their frankness and kindly spirit. Translations of a few excerpts are presented herewith. Many A.S.A.E. members will no doubt wish to read the reports in their entirety.

The speakers were Dr. Kuehne* of Munich, "Technical Helps and Devices of North American Agriculutre;" Mr. Deick of Peest, "Animal Breeding and Feeding in the United States;" Dr. Roemer of Halle, "Experiences of the Agricultural Study Trip to America," and Dr. Brinkmann of Bonn, "Development Tendencies of American Agriculture and their Lesson for German Agriculture." Dr. Lichtenberger of Kiel is said to have reported on his special study of "American Dairy Industry and Machinery," but his report is not found in the special edition of the Mitteilungen.

Dr. Kuehne. "In Germany the land area used in agriculture is a minimum, in America the human labor is a minimum . . . . . For each American farm laborer there is five or six times the field area used by the German laborer . . . . . Shown by statistics carefully collected by the U.S.D.A. that the power per laborer in American agriculture is 3.7 times as much as for each German . . . . About 10 times on the Pacific Coast . . . . Last year less than 7 per cent of American farmers used electricity for lighting and power . . . . Fifteen per cent of American farmers use windmills.

"About twelve American factories producing tractors. . . Annual output about 250,000 to 300,000. . . The great bulk of agricultural tractors are built similar to Fordson, two drive wheels and two steering wheels.

"In his effort to produce a cheap tractor, Ford (viewed from the standpoint of agriculture) seems to have gone to an extreme limit in making important parts lighter. Also his attempted simplicity of construction has in many cases been secured by devices that later are liable to lead to expensive repairs. Also the 18-horsepower capacity is found insufficient for many farm operations. . . . These opinions are frequently met in America and are based on wide experience, since, because of its low price, the Fordson has been purchased by many farmers. . . These opinions are established by the fact that almost all other leading makes of American wheel-type tractors despite their higher price find a ready sale in agriculture.

"It deserves especial mention that a number of American tractors are equipped with a device known as a power takeoff.

"The desire to conserve man labor is so great that quality of the work is sometimes sacrificed to a degree that our farmers would not tolerate. . . Example: American grain fields appear less carefully sown than ours. However, since cultivation of small grain is not practiced in America, this circumstance is not regarded as of much importance.

"In my whole trip I did not once see hay loaded by hand fork as we do it. Hay loaders are used."

He recommends the riding plow for German use as tending to produce a less weary and hence happier and more intelligent farmer.

He mentions combined harvester-threshers as an example of the keen thinking of American implement designers. Not usable in German climate.

Quoting Dr. Kuehne again, "Threshing machine building in America has gone a different way from that pursued in Europe. The machines in America were designed for maximum capacity with minimum man-power requirement. However, little attention was given to preservation of the straw in good condition and to careful cleaning and sifting of the grain. Both of these things are opposed to the fundamental propositions in our agriculture, and hence the American threshing machine will find no footing in Germany. A similar situation exists with regard to American machines for cleaning and sifting grain required for seeding. So far as I was able to determine American machines for these purposes deserve no complimentary mention.

"The use of corn for silage accounts in large measure for America's abundant milk supply which every traveller notes. (Different silo construction mentioned.) Many farmers build their own silos following plans furnished by the state experiment stations.

"Efficeacy meets one on every hand on the American farm. In my presence one man in seven hours time using an atomizing paint spray covered with a neat, satisfactory coating of paint a farm building 50 meters long, 15 meters wide and 6 meters average height.

"A word concerning the use of electricity in American agriculture. This source of energy is of little consequence on the average American farm and there are relatively few networks of rural electric lines. An exception is furnished by the state of California where the numerous and large energy requiring irrigation pumping plants require overland networks. Costs of 2 cents per kilowatt-hour or less enable uses of electricity that could not be thought of in Germany. Thus fruit is dried in electrically heated kilns having a capacity of 15 tons of fresh fruit daily. (Evidently this must refer to walnuts.) Also eggs are hatched electrically.

"In conclusion I will summarize the results of my observations. The American agricultural machine industry has set as its task to produce machines of maximum capacity and minimum man-power requirement. The solution of this problem has been in a large measure successfully accomplished. The task was made lighter in that American agriculture made lower quality requirements for the work of the machines. If the question is raised whether my observations can be applied directly to German agriculture, the answer must be that this is not possible. Naturally each case must be decided on its own requirements. In many cases ideas may be adopted by us as they are or altered as may be necessary. The knowledge gained should stimulate our machine industry to produce larger capacity machines without sacrifice of quality of work. At present, however, it is questionable whether the condition of agriculture and industry would warrant the introduction of new expensive machines. Nevertheless it would be shortsighted to neglect the needs of the future, and I hope our farm machinery manufacturers will get to work on the problems I have indicated and in which our agriculture is deeply interested.

"Another thing I should by all means mention. The position of American agriculture among the industries is quite different from the position of German agriculture. The average American takes a lively interest in the well-being of agriculture since he recognizes correctly its high value. With us unfortunately this recognition is often lacking, and it is of the utmost importance that the average German citizen should understand the needs of agriculture better than has heretofore been the case. Further, the American farmer understands that without the help of engineering he cannot farm satisfactorily. He does not look upon the engineer, as still may often be observed among us, as a necessary evil that he cannot avoid, but as a practical, experienced friend who helps him to success. May this spirit soon enter German agriculture also, so that to its own great advantage it may learn to use the conquests of science."

Dr. Roemer. "The yields average about one-half as great per hectare as those of Germany. In consequence we were at first asked repeatedly: What are you seeking among us, you have so much greater yields? What do you expect to

*Member A.S.A.E.

"I must again emphasize the fact that cooperation between professors and scientists is glowingly exemplified in America. The cooperation of associates at a given station, and also the mutual cooperation among specialists of different lines at different stations is organized on a truly large scale. This naturally implies that they as men and as technicians esteem one another, and . . . say: I am very glad that I am privileged to discuss thoroughly my scientific work with others."

learn among us, you have so much better field technique? Now we nod assent very readily to all this and look down upon agriculturists who harvest only half our yields. We must not forget, however, that the profit depends not alone upon the yield per hectare but also upon the cost of production. Over there one-half the yield per hectare, but four times the wages, and in spite of that a resulting return or production per worker four to five times as high as ours.

"As was told you yesterday in Mr. Deike's address, it is somewhat different in the realm of animal husbandry. The production per animal, for example milk production or growth of pork or beef, is not inferior to ours, but many times higher than with us.

"I must again emphasize the fact that cooperation between professors and scientists is glowingly exemplified in America The cooperation of associates at a given station, and also the mutual cooperation among specialists of different lines at different stations is organized on a truly large scale. This naturally implies that they mutually as men and as technicians esteem one another and do not say as here in Germany: I will not permit my associates to control me, but say: I am very glad that I am privileged to discuss thoroughly my scientific work with others working along the same lines so that I may receive new inspiration."

Dr. Brinkmann. "Though the American farmer will hardly shows us any advance in intensification yet may he not easily show us, by that skill in which he is the schoolmaster of the world, how to decrease the farmers' cost of production and so spring new surprises in the markets of the world? It is truly said that McCormick, by the practical solution of the problem of grain binding, laid the foundation for the agricultural development of the American West. Also other machines, for example, the corn planter, the machine for removing cotton seed, the rolling mill, have had epochal significance in the development of American agriculture, such as has not been found elswhere in the world's agricultural history. Is it possible that the explosion motor and the tractorization of agriculture is destined to produce similar results, if not in the opening up of new areas, then in the reduction of production cost and increasing of the per cent of the crop available for marketing? More than one-fourth, nearly one-third of the total American harvest is today used for feeding draft animals. From the acreage needed to nourish these animals sufficient crop could be obtained to sustain 30 to 35 million people. In the corn belt 30 to 40 per cent of the costs are for maintenance of draft animals; this is about the only item in which efforts to reduce costs seem destined to meet with success.

"The use of tractors has spread rapidly in American agriculture. The 1920 census shows about 230,000 farms equipped with tractors (3.6 per cent of all farms). In the Dakotas at that time every sixth farm had a tractor. This is in the center of the spring wheat section. Since that time the number of tractors has increased immensely—doubled at least, if not trebled.

"From a searching investigation, from talks with practical farmers, and from the literature of agriculture and of implements I have obtained the impression that the tractor even in America is still in the experimental stage. The tractor is still far from being a recognizedly necessary piece of equipment on every well-conducted farm, as are many other machines designed for farm uses or for harvesting purposes or even the personally used automobile, the absence of which is today regarded as an indication of poor management.

"Views as to the importance of the tractor in American agriculture differ widely. There is a united opinion as to one thing—that Ford's 'horseless farming' idea is a mere fantasy. At present it is only a question of the supplementing of the animal power by motor power at the times of peak load. Even this supplementing encounters a difficulty in that of the two peaks one but not the other can be tractorized; so that reduction of animal power is possible only within very narrow limits. This is especially true of the corn belt where tillage may be very largely tractorized but not corn cultivation, haying and wheat harvesting, which run together in such fashion as often to produce the peak load of the whole agricultural year. A more favorable situation for profitable use of tractors is found in the winter wheat regions, and still more so in the spring wheat regions with their labor culmination point early in the spring and their favorable weather during the harvest season.

"By careful investigation it has been found that on the average in the corn belt 18 to 20 per cent of the animal power may be replaced by tractor power, and in the spring wheat belt up to 30 per cent. There are some types of farming in which motorization has progressed farther, but these are special cases (orcharding and viticulture in California) which have little significance for the average farmer. The saving of human labor inherent in the use of the tractor generally remains a latent possibility. Instances of reduction of the number of seasonal laborers required have been found; these however hardly mean a pecuniary gain since the seasonal laborers are worked to full individual capacity anyway. There would be a notable advantage in labor saving if the laborers in question would have to be kept for a considerable period but not always working at full capacity. The number of these laborers is so small on the average farm as to make further reduction impossible. About 10 million farmers and farm laborers are working 6.5 million farms of an average size of 60 hectares. That is an average of about 1.5 permanent workers per farm. Thus, as American agriculture is at present constituted, there is very small chance of the tractor reducing the number of farm hands.

"For the same reasons the financial advantage of the use of the tractor is in general quite problematical. For certain kinds of work (plowing with multiple bottom gangs or disks) there may be a saving of cost; but such savings do not count heavily in the annual total, since they are offset by interest and depreciation on a heavier outlay for machinery. To be sure there are to be found in America instances of farmers who make the tractor pay a profit even though the tractor neither lowers the production cost nor increases the crop return per hectare. The farmer by the help of his tractor can cultivate reserve areas or by purchase or renting of other land increase his holdings so as to give himself a higher net income. As a matter of fact it is noticeable that the average farm size is becoming larger in the regions where tractors have been used for several years. This tendency naturally cannot be very strong, it must diminish in proportion as the use of tractors spreads. As I see it the agricultural tractor is still fighting to show its profitableness. A sudden decrease in costs of production in American agriculture because of tractorization in view of past experience is not to be looked for."

(EDITOR'S NOTE: We are indebted to A. H. Hoffman, research specialist in agricultural engineering, University of California, for the foregoing translations of excerpts from a special reprint of the journal of the Deutsche Landwirtschaftliche Gesellschaft.)

Use of Machinery in Cotton Production

By D. W. Watkins

Assistant Director Extension Service, Clemson College of South Carolina

WHEN there is any discussion of the use of machinery in cotton production someone usually makes the point that there is little need to improve our farming by the use of labor-saving machinery, due to the fact that with our old implements we can produce as much cotton as we can harvest. This argument is a fallacy, at least in that part of the cotton belt where we have over forty inches of rainfall. After all, the farmer's effort is to produce as large an income as possible in order that he may maintain a high standard of living.

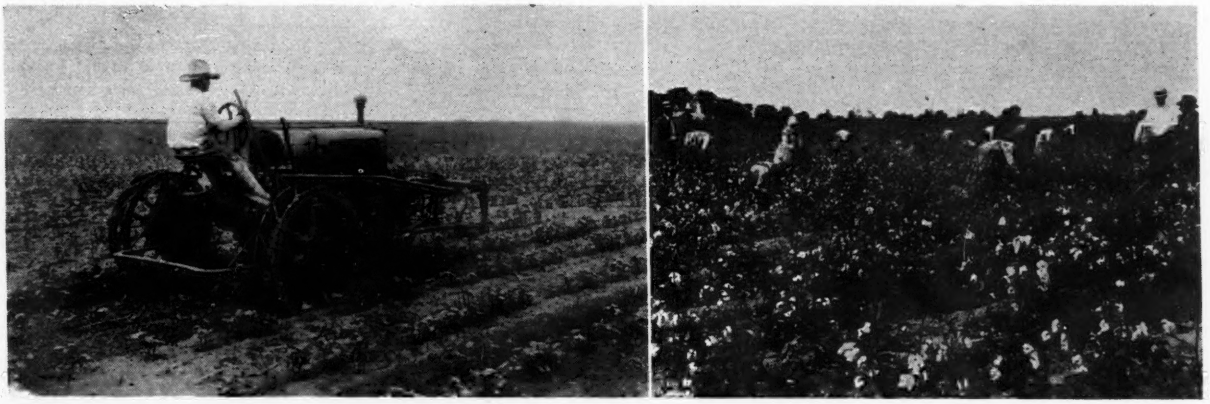
In Texas the yield of lint cotton per acre has been decreasing for the past sixty years. The Texas farmer, however, has adopted the use of labor-saving machinery, has increased his acreage by that means, and now produces more cotton per family than he formerly did. His standard of living, therefore, is perhaps better than it was some decades ago. In the eastern part of the cotton belt, especially in the Southeastern cotton states, farmers have attempted to maintain large yields per family by the use of commercial fertilizers rather than by the use of labor-saving machinery. This solution undoubtedly is correct up to a certain point.

As long as the use of the old implements requires practically all of the spring and summer working hours to grow as large a crop of cotton as the farmer can harvest, very little time is left for producing other crops. The great hindrance to diversification is not that we do not have sufficient land on which to diversify, but that we do not have sufficient time in which to produce diversified crops along with a normal cotton crop. The Southeast would be immeasurably improved if the present cotton crops could be produced with half the man labor now required, provided the rest of the man labor were utilized to produce other crops, especially those which are required for farm consumption. It lies entirely within the realm of possibility to produce, on less acreage and with half the present labor, our present cotton crops up to the time of harvest. This can be done by building up our soil fertility so that we can get larger yields per acre coupled with the use of labor-saving machinery. When we reflect that the average yield of lint cotton per acre for South Carolina has been only around 152 pounds during the past five-year period, it appears that the use of labor-saving machinery coupled with the improved yielding capacity of soils is about the only way that the state and similar territory can continue to produce cotton.

The recognition of an agricultural problem by a few leaders and their understanding of a correct solution is but a preliminary step toward solving the problem. Until the solution becomes a matter of general farm practice the problem still exists. Most agricultural leaders will now agree that labor-saving machinery is very desirable. However, the majority of cotton farmers are not even acquainted with many of the machines that might be economically useful to them. Among the farmers who do recognize the value of improved farm machinery many are not financially able to purchase such machinery. In addition to those two causes there is another factor which delays the coming of the day when our farming will be more on a machine basis, and that is that farmers who have for many years been accustomed to conducting their farm operations with familiar implements frequently do not care to change to untried machinery. They do not believe that other methods and practices will prove profitable. This is a characteristic not confined to farmers, but simply indicates that farmers are full of human nature.

Granted that agricultural leaders and a few of the best farmers agree that by the use of a certain new farm implement individual farmers would be better off, it still remains to train farm labor to use this new implement efficiently. Virtually a new generation of farm labor must be trained before any radical statewide changes in our mechanical practices can be effected. Such changes usually come about very gradually. Perhaps we shall first learn to use a single implement and then another, and so on until after the passage of a number of years there will be a perceptible improvement in the efficiency of our farming due to the use of labor-saving machinery. It seems to the writer that one of the first implements that should be used is the one-row cultivator. We are also sadly in need of developing the wider use of two, three, and four-horse teams in the preparation of land for planting. This, of course, is being done by our best farmers, but since in South Carolina about two-thirds of the farming is carried on by tenants there is still a great need to develop the use of more than one horse in preparation.

The whole question of using machinery is very closely allied with future farm prosperity. Much of our farming as conducted on the old inefficient one-horse basis is doomed; in fact, it is very hard now to find any American citizen with as low a standard of living as the Southern one-horse cotton farmer. If all of the homes of such farmers were placed side by side there would be no difficulty in locating the slums of the United States.



Even though picking, as shown in the scene on the right from Sumter County, South Carolina, constitutes the peak labor requirement in cotton production, and will continue to be the limiting factor, at least until mechanical harvesting is perfected and adopted, it does not follow that inefficient methods of tillage are to be condoned. Efficient use of labor in growing the crop, as shown at the left, permits raising of the supplementary food and feed crops which are the need of cotton farming

The Porous Dam Method of Erosion Control

By Gottlieb Muehleisen

Mem. A.S.A.E. President, National Soil Conservation Company

AS AN important part of a general practice in soil protection and erosion control, the company with which the author is connected has made extensive use of what we call porous check dams and has developed through a rather long experience an engineering technique for their application. Under conditions where its use is indicated the outstanding advantages of the porous dam are minimum cost of installation and greatly reduced liability to washing out or undermining.

The porous dam may well be symbolized by the grid. Not only does the dam itself often consist of a typical grid construction, but in the nicety and effectiveness with which it controls the behavior of powerful currents, the porous dam may be likened unto the grid of a radio vacuum tube. The main underlying principle of the porous dam is the fact that the ability of running water to carry suspended solids is a function of stream velocity.

In erosion control the purpose is not to impound the water —in fact, this usually would be objectionable—but to intercept its suspended load and cause the latter to be deposited at the will of the engineer. The porous dam permits the water to flow through it with only a partial degree of impounding at times of flood. The workings of the system may best be grasped by considering the construction and behavior of a typical installation.

Let it be assumed that it is desired to check further erosion and fill up a gully already made. The dam may consist of an open fabric of wire, much like a woven-wire fence, of a grid consisting of vertical steel bars, with horizontal supporting members at top and bottom, or of steel stakes set in the stream bed and connected at their tops by a steel channel or similar shape for mutual reinforcement.

In time of flood water, when occurs most of the damage which the dam is to prevent, and when also the dam performs most of its constructive work, the debris carried by the flowing water consists of rock fragments ranging from boulders to fine soil, and also of floating material, chiefly weeds and other vegetation. The first action of the newly built dam is to intercept some of this floating material, as shown in Fig. 1 thereby checking the velocity of flood waters very materially, and causing them to back up and form a temporary pond on the upstream side. In this pond the velocity is very low, and suspended matter is dropped, beginning the fill above the dam. As the water level rises and falls during the course of a flood, the intercepted floating material is distributed from the bottom of the dam to the maximum water level attained, and in succeeding floods, as the stream bed above the dam becomes filled, this level becomes higher and higher. Eventually, the deposited material fills up all of the space to the top of the dam and extending upstream at a gradient determined by the amount and character of the suspended load of the stream. When this point is reached another porous dam may be built right on top of the old one and the grading-up process continued.

In controlling erosion over a gully or valley of any length, dams are placed at intervals along the stream. One of the principles to be observed in such an arrangement is that the top of one dam must have aprpoximately the same elevation as the bottom of the dam next up stream. In carrying out this principle in an installation it sometimes happens that some of the upstream dams will be suspended with their bottoms high and dry above the stream bed by distances which may reach ten feet. Nevertheless these dams come into operation when those below have built the stream bed up to the level of their tops. When the process is complete the stream bed is a series of steps or terraces.

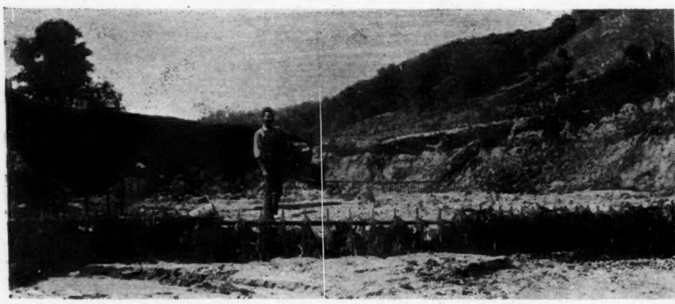
Not only is the profile of the stream a series of steps, but its cross section may also be stepped. This is done in part by varying the height of the dam and the spacing of its members, and also by the use of supplementary dams parallel to the course, or the desired course, of the stream. In Fig. 1 may be seen, at the left, such a longitudinal dam in the form of a woven-wire fence, the more open spacing of the main dam members in the middle, while in the background may be seen the next dam upstream.

The effect of the stepped or terrace construction from middle to edge of the stream is to make the velocity highest at the middle and lower at the sides, an arrangement which holds the stream to its course and prevents shifting.

In all cases the dams are supported by reinforcing cables running upstream to suitable anchors. The anchors and cables are, of course, buried when the filling is completed, making a self-contained, securely anchored deposit. The kind, size, spacing, and anchoring of the various dam elements is a matter of judgment based on experience.

The porous dam is not limited in its usefulness to the filling up of gullies and valleys. In the case of valleys subject to occasional floods porous dams can be so designed and installed as to have the effect, not only of holding the main velocity and flow of the stream where desired to avoid damage to land along the bank, but also to insure the deposit of a layer of silt, thereby enhancing the fertility of the soil by recapturing some of the material eroded farther up stream, emulating in this respect the practice of the ancient Egyptians in the valley of the Nile.

In Fig. 2 is shown an installation of porous dam construction to guide a stream between the abutments of a bridge, protecting the latter from erosion. It will be noted that instead of waiting for floating material to be brought and deposited by the stream, brush has been piled on the side of the dam next the bank where filling-in is desired. There will also be noted a gap of lower height through which the flow from a roadside ditch may enter the main stream under control. Such an installation takes the place of rip-rap at



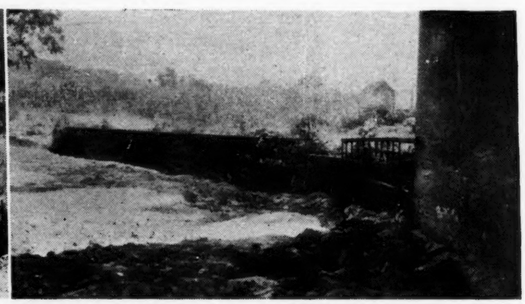


Fig. 1. (Left) A typical porous dam in process of filling a wide gully. Note longitudinal wire fence dam at left, wider spacing of vertical members at middle of main dam, and the next dam upstream in background. The dam in foreground often is submerged several feet during floods. Fig. 2. (Right) A porous dam used instead of rip-rap to direct water beneath a bridge and protect its abutments


Fig. 3. (Left) The porous dam shown here was installed to divert the river from a highway which it threatened. Fig. 4. (Right) The same location as Fig. 3, viewed from a slightly different angle, a few months later

much lower expense, particularly where, as in this case, a fill would be necessary to establish the desired boundary of the stream.

The dam shown in Fig. 3 was built to turn the course of a stream which was threatening a highway. As shown in Fig. 4, representing the condition a few months later, the objectionable bend was filled up and the river diverted to another channel. In this, as in all applications of the porous dam, the stream is made to furnish its own material, place it, and thereby effect its own control.

Strength of Lap Soldered Joints

By J. Grant Dent

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TO DETERMINE the effect of different fluxes and solders on the strength of lap soldered joints, tests were made by the author in the laboratory of the division of agricultural engineering, University of Minnesota. The breaking stresses were determined by the use of a Raleigh testing machine, and the figures given in the accompanying table represent the average of ten tests, except when a larger number of tests was made as noted below.

In all cases a lap of ⅛ inch was used, as the results of hundreds of tests of this style of joint indicate this width of lap as giving the best results. In nearly all cases where a wider lap has been used there are places in the joints where the solder has not penetrated all the way through, leaving a pocket filled with flux.

Strength Tests of Lap Soldered Joints
Width of metal 2 inches. Lap of joint ⅛ inch.

Metal	Solder	Flux	Breaking load pounds (average of 10 tests)
Tin plate, XXXX	50-50 com'l solder	Zn Cl_2+¼ water	1520
Tin plate, XXXX	50-50 com'l solder	Zn Cl_2, full strength	1386
Tin plate, XXXX	50-50 com'l solder	Com'l soldering salts	1479
Tin plate, XXXX	50-50 com'l solder	Com'l soldering paste	1479
Tin plate, XXXX	50-50 com'l solder	Rosin	1432
Tin plate, XXXX	Kester acid-core	Kester acid-core	1402
Tin plate, XXXX	Solderall	Solderall	1570
Tin plate, XXXX	Block tin	Zn Cl_2+¼ water	1245
Tin plate, XXXX	70% tin, 30% lead	Zn Cl_2+¼ water	1554
Tin plate, XXXX	60% tin, 40% lead	Zn Cl_2+¼ water	1586
Tin plate, XXXX	50-50 mixed in laboratory	Zn Cl_2+¼ water	1640
Tin plate, XXXX	40% tin, 60% lead	Zn Cl_2+¼ water	1489
Tin plate, XXXX	30%, tin, 70% lead	Zn Cl_2+¼ water	1415
Tin plate, XXXX	Lead	Zn Cl_2+¼ water	826
Copper, 25 ga.	50-50 commercial	Zn Cl_2+¼ water	1310
Copper, 25 ga.	Block tin	Zn Cl_2+¼ water	1234
Sheet steel, 25 ga.	50-50 commercial	Zn Cl_2+¼ water	1415
Sheet steel, 25 ga.	Block tin	Zn Cl_2+¼ water	1137
Galv. steel, 26 ga.	50-50 commercial	Zn Cl_2+¼ water, not removed	1137
Galv. steel, 26 ga.	50-50 commercial	Zn Cl_2+¼ water, galv. removed by scraping, emery cloth, and HC1.	1333

Tensile strength of sheet metals used in above tests; width of pieces 2 inches.

Tin plate	XXXX	2140 pounds
Copper	25 ga.	1230 pounds
Zinc	25 ga.	1030 pounds
Steel	26 ga.	1880 pounds
Galv. steel	24 ga.	2100 pounds

In making these joints the surfaces to be united were both tinned, but instead of running the soldering copper over the upper sheet, as is often done in making sweated joints but which smears this exposed surface with solder and renders it unsightly, the heat for sweating was applied by running the copper along the joint on top of the lower sheet and against the edge of the upper sheet. It is believed that for a joint as narrow as this the heat flows freely enough through the metal of the sheets to bring all parts of the joint to a sweating temperature, and that manipulation in this manner gives the best assurance of solder flowing through the entire width of the joint and replacing the flux.

There is a prevalent belief that in crimped or folded seams where it is impossible to wash or wipe off the excess of flux less corrosion will ensue when the flux is zinc chloride solution diluted with one-fourth its volume of water than when it is not so diluted. The question arose as to what effect such dilution has on the strength of the resulting joint, and tests were made to throw light on this question, although, as stated, the test joints were of the lapped variety. Owing to the results being somewhat unexpected, the tests were repeated, making a total of twenty joints tested for each of the first two items as they appear in the table.

The flux designated in the table as full strength zinc chloride is a solution prepared in the usual manner by adding pieces of zinc to commercial hydrochloric acid and letting it work until action ceases before removing the excess of zinc. It is to be noted that while this is the strongest solution which may be obtained by the procedure ordinarily followed in tinsmithing, it is not a saturated solution of zinc chloride. The diluted solution was made by adding to the original solution 25 per cent of its volume of water.

It is widely believed that the higher the proportion of tin in solder, the stronger and better it will be. That this belief is not justified is indicated by that portion of the table in which XXXX tin plate fluxed with diluted zinc chloride was joined with solders of varying proportions, ranging from block tin to lead. It will be noted that the strength increases regularly with the proportion of lead until the fifty-fifty mixture is reached, after which it falls off rather sharply. The solders used in this group of tests were carefully mixed in the laboratory, and the fifty-fifty mixture not only exceeded

in strength all other proportions but showed strength materially higher than commercial solder of the same nominal composition, which was used under the same conditions in the first test listed in the table.

Another common belief is that block tin is the strongest material for joining copper. However, the tests would seem to indicate that it is inferior in this respect to fifty-fifty commercial solder.

Black sheet steel, or stove-pipe iron, is considered by some as being difficult or impossible to solder. The author's tests indicate not only that it is very easily soldered if properly cleaned, but that it produces a joint of very fair strength. Here, too, fifty-fifty solder (commercial) proved materially stronger than block tin.

Comparison was made of the strength of joints obtained with galvanized steel in which the galvanizing was thoroughly removed before soldering, and where this was not done. When the galvanizing is not removed, the limiting element in the strength of the joint is the adhesion between the steel and the zinc, and failure occurs by the solder pulling the zinc coating from the steel.

No tests with sheet zinc are reported in the table but it may be remarked that this metal, even in fairly heavy gauges, breaks before the soldered joint fails.

First Hand Experience With the Combine

By Burton S. Harris

Chief Engineer, Massey-Harris Company, Ltd.

THE question is frequently asked these days as to the territory in which the combined harvester-thresher, now commonly called a "combine," can be used. Generally speaking the answer is that wherever you have a field of fall or winter wheat you can use the combine.

As an example of the advantage of using the combine, I bought a field of wheat from a farmer and left it standing in the straw a month after the wheat on neighboring farms had been harvested. Then I harvested it with a combine and sold it to the farmer from whom I bought it for more than I paid for it. This farmer in turn sold it to farmers in the community for seed wheat at a fancy price.

The harvesting of spring wheat with a combine is a big problem, especially because it usually contains a great deal more weeds than winter wheat. Also one thing that creates this condition is the fact that we have a poorer class of farmers in the spring wheat territory. The farmers of Oklahoma and Kansas are among the best farmers in the world. Because of the weedy condition of grain in the spring wheat territory, radical changes will be necessary to overcome this condition.

In my opinion, what will be necessary for using the combine in spring wheat is that the first part of the crop be cut and raked into windrows. Later the combine, equipped with a pick-up device, can be used to elevate the wheat in the windrows and thresh it. As the crop ripens, the latter part of the crop can be harvested by the combine.

As a matter of fact, the combine has been successful in any kind of crop in which they have been used. They have already been used considerably, with varying degrees of success, in harvesting soy beans. Considerable development is necessary, however, to make the combine a success for this purpose. Improvements are needed to prevent the beans going over with the stems, that is, that will shave or beat the beans out of the stems. It is true, however, that even now the combine is the most successful and efficient way of harvesting beans.

Another important change which, in my opinion, is necessary, for the success in using the combine in soy beans, is the varying speed on the cylinder. What is needed is a cylinder speed that is slower for beans than for grain, but with the rest of the machine operating at the same speed.

Incidentally, I knew of a farmer who cut sweet clover with a combine and found it very successful.

One of the big problems engineers responsible for the design of the combine have been confronted with is the weight of the machine. We started out to build small machines, but the tendency now is for the weight to increase. In designing a combine it is, of course, necessary not to get too much weight. In Kansas, for example, it is difficult to move the machine through the sand that is encountered.

As to the size of machine, the trend which seems to me will be the most logical is toward the 10-foot machine, which will operate at four miles per hour, which is better than a wider table machine running at three miles per hour.

I do not believe that the ultimate combine will look very much like the present machine. The machine of today is cumbersome. The designer is up against the problem of cross conveyors. With our present designs we do not get the grain into the cylinder the way we should. I do not believe that we get the cylinder low enough.

The experimental department in connection with the development of the combine labors under the difficulty of getting proper information from the field force as to the operations of the machines in the field. In improving our designs we should be able to find out the weak points of the machines in operation in the field.

It has been my experience that the biggest complaint on combines is from breakdowns and not from the loss of grain. Another thing is that we are very backward in developing the oiling system of the combine. It takes about thirty minutes to oil one of the present-day machines. In my opinion, lubrication development should be along the line of auto lubrication.

Fifteen tractor-operated mechanical corn pickers at work on Fairview farm, Odebolt, Iowa, owned and managed by W. P. Adams and his son, R. B. Adams, respectively, doing the work of ninety hand pickers. There are 7000 acres in this farm

Agricultural Engineering Digest

A review of current literature on agricultural engineering by R. W. Trullinger, specialist in agricultural engineering, Office of Experiment Stations, U. S. Department of Agriculture

The Effects of Various Methods of Applying Fertilizers on Crop Yields, D. G. Coe (Soil Science, 21 (1926), No. 2, pp. 127-141).—Studies conducted at Iowa State College are reported. While no definite conclusions are drawn, it is recommended that a combination fertilizer-grain drill be used in fertilizing cereals like oats and wheat. Moderate applications of noncaustic fertilizers were found to give the most economical returns by this direct-contact-in-the-seed-rows method. As much as 400 pounds per acre of 16 per cent acid phosphate or 300 pounds of commercial 2-12-2 fertilizer were drilled with the seed without appreciable injury to germination or reduction in yields.

The results indicated that larger applications than these or the distribution of fertilizers containing caustic ingredients like Cyanamid should be made separately from the seeding. The best yields with Cyanamid came from broadcasting it ten days in advance of the seeding. For large applications of noncaustic fertilizers, the best method appeared to be a splitting of the total application between the drilled direct-contact-in-the-seed-rows method and the broadcast method.

The results showed no advantage in spring applications either for the entire fertilizer application or for part of it. The drilling of the fertilizer as a separate operation to the seeding, no matter what the depth or the time period before the seeding, was not equal to the direct contact method, provided moderate amounts of the noncaustic fertilizers were used. The use of a second set of delivery pipes for distributing the fertilizer above the seed row was found to safeguard the germination, but failed to give benefits warranting their adoption. Where broadcast applications of fertilizers were made with a lime sower or by other means upon the seedbed surface, the best results were secured when the fertilizer was worked into the soil by thorough disking.

In the fertilization of corn the hill methods appeared equal to or even superior to the broadcast method if the fertilizer was not delivered into the hills in direct contact with seed. Earlier maturity was secured with the hill method. Comparisons of the rear of hill and sides of hill methods indicated that the latter were preferable. It did not give the direct contact in the hill location as the rear of hill method often does, and hence the sides method is recommended over the rear method for preventing injury to seed germination. The results are taken to indicate that a satisfactory design of attachment is needed to guarantee the sides location of the fertilizer for all machines sowing seeds in wide rows or in hills, such as corn, cotton, beets, and potatoes. In fact, the sides lower plane location for the fertilizer gave the best yields of potatoes in these studies.

Ventilation and Its Relation to Wet Litter, J. S. Carver (Washington College Station Bulletin 196 (1925), pp. 37, 38).—Studies of the ventilation of poultry houses showed that there was practically no difference in the winter, especially during the cold weather, in the temperature and relative humidity in two pens of equal size, one with and the other without a straw loft. However, during the warm weather the straw loft pen was about 5 degrees cooler than the pen without a straw loft. The amount of moisture in the litter in the straw loft pen was very heavy, being often 30 per cent within a week's time. The straw loft averaged about 12 per cent moisture content, and it appeared that the straw in the loft did not absorb any moisture from the litter. During the winter months the temperature and relative humidity of open front houses averaged about 5 per cent higher than those on the outside. They were about the same during the summer months.

Regulation of Drainage Apparatus Called Septic Tanks, A. Calmette and E. Rolants (Rev. Hyg., 47 (1925), No. 6, pp. 481-489; abs in Chem. Abs., 19 (1925), No. 20, p. 3136).—Proposed regulations for septic tanks for isolated residences and unsewered parts of cities in France are briefly set forth. The regulations require a trickling filter or bacterial bed to follow tank treatment. The size of the tank must provide a minimum of 250 liters (66 gal.) per person where water closets only are connected and 500 liters per person where kitchen wastes are added. Bath water, roof run-off, etc., are to be excluded. The trickling filter must have a minimum depth of one meter (3.28 ft.) and an area of one square meter for every ten people with a minimun total area of 0.5 square meter. If the effluent contains more than enough organic matter to produce 200 parts per million of ammonia it must be diluted. The effluent must not contain more than 30 parts per million of suspended organic matter, and a stoppered 150 cubic centimeter sample kept 7 days at 30 degrees Centigrade (86 degrees Fahrenheit) must not show evidence of putrefaction.

The Disposal of Dairy Wastes, L. C. Burroughs (Journal Dairy Science, 7 (1924), No. 5, pp. 503-523, fig. 1).—Studies conducted by the Maryland State Department of Health are reported which showed that flocculation and sedimentation of the case in milk wastes is satisfactory within the pH limits of 4.5 and 4.9. The supernatant liquid resulting from waste so treated has a high relative stability number. It was found that after detaining the treated waste in tanks until good sedimentation has occurred the supernatant liquid can be discharged into a small stream or ditch without causing a nuisance.

Dust Control in Grain Elevators, H. R. Brown and J. O. Reed (U. S. Department of Agriculture, Bulletin 1373 (1926), pp. 48, figs. 37).—Office, field, and laboratory studies for the purpose of developing means for the control of dust in grain elevators are reported.

It has been found that the dust conditions in a grain elevator are effectively controlled only when (1) dust clouds are eliminated at their point of origin by the application of suction, (2) dust accumulations are promptly removed from the building either by a vacuum cleaning system or by a floor sweep system, and (3) the elevator and equipment are well ventilated. The mechanical method of controlling dust conditions were therefore divided into dust collection and dust removal in the investigation. A large amount of mechanical and technical details is presented.

It is concluded that dust collection in grain elevators may not prevent explosions, but that it will keep a small dust ignition from developing into a disastrous explosion. As the result of these experiments with special laboratory equipment, a new dust handling equipment has been designed which should meet all objections to the installation of such systems on the ground that they affect the weight of the grain.

Tests of Carbon Deposition in Internal-Combustion Engines, D. R. Brooks (Journal Society Automotive Engineers, 18 (1926), No. 1, pp. 48-52, figs. 5).—The results of an investigation of the formation of carbon in an internal-combustion engine and its influence on the performance of the engine are reported.

It was found that special methods of controlling the character and quantity of lubricating oil that reached the combustion chamber were necessary to obtain concordant results on successive tests. It was further found that carbon formed in internal-combustion engines arises from thermal decomposition and oxidation of the lubricating oil. Factors that influence the rate of deposition of carbon are those which affect the quantity and character of the lubricating oil that reaches the combustion chamber and its rate of break down in that chamber.

An increase in carbon deposit increases the indicated thermal efficiency of an engine, and the gain in efficiency is proportional to the increase in the carbon deposit. An increase in absolute humidity in the air-fuel mixture appears to increase the indicated thermal efficiency of an engine.

It is concluded that the total quantity of carbon that would be formed in unlimited time is dependent upon the conditions of engine operation.

Net Requirements of Crops for Irrigation Water in the Mesilla Valley, New Mexico, D. W. Bloodgood and A. S. Curry (New Mexico Station Bulletin 149 (1925), pp. 48, figs. 17).—Observations made in cooperation with the U. S. Department Agriculture Bureau of Public Roads on the duty of water for alfalfa, wheat, peaches, corn, potatoes, soy beans, grapes, tomatoes, cabbage, Sudan grass, onions, rye, cotton, sorghum, oats, barley, sweet potatoes, and chili are reported.

The best duty for alfalfa was obtained from about 50 inches of water applied in 5-inch irrigations and for wheat from about 15 to 20 inches applied in 4-inch irrigations. The duty for miscellaneous crops varied widely with the crop. The irrigation season for alfalfa was about 6.5 months and for wheat about 8.5 months.

The yields of most of the crops seemed to be more closely correlated with the amount of water applied than with the soil type. The yield of alfalfa per acre-inch decreased with the amount of water applied. The yield of wheat per acre-inch varied from 27 to 201 pounds.

Handbook of Steam Engineering, W. E. Biggs and W. R. Woolrich, (Knoxville: Engineering Press, 1925, pp. [4]+389, figs. 101).—This is a handbook of practical information on the subject, which deals primarily with power plant operation, construction, and maintenance.

Dust Explosions, P. Beyersdorfer (Staub-Explosionen. Leipzig: Theodor Steinkopff, 1925, pp. VIII+125, figs. 14).—This book deals with dust explosions and their prevention, more especially in Europe, and draws attention to the work on this subject which has been in progress in this country. It contains chapters on the frequency and extent of dust explosions, dust, nature of the explosion, the dangerous properties of dusts, dangerous forms of energy, mixed dust and gas explosions, explosions of decomposed dust, action of dust explosions, the danger of dust accumulations, and the prevention of dust explosions.

Agricultural Engineering [Studies at the Arkansas Station] (Arkansas Station Bulletin 203 (1926), pp. 21-23, figs. 2).—Data are very briefly presented on tractors, farm electric light plants, farm building plans, and the development of farm water systems.

Experiments on the durability of fence posts indicated that gal-

vanized metal posts showed no deterioration in the third year. Painted metal posts showed rust where scratched. Untreated oak posts and posts treated by dipping in creosote showed decay at the ground line. Commercially treated pine posts showed no decay.

Tentative Methods of Testing Smooth-Surfaced Asphalt Roll-Roofing, Slate-Surfaced Asphalt Roll-Roofing, and Slate-Surfaced Asphalt Shingles (American Society Testing Materials Proceedings, 25 (1925), pt. 1, pp. 792-796).—These method cover the examination of roofings and shingles composed of roofing felt, saturated and coated on both sides with asphalt, and surfaced on the top with either powdered or granulated mineral matter, and on the under side with powdered mineral matter.

Tentative Methods of Testing Felted and Woven Fabrics Saturated With Bituminous Substances for Use in Waterproofing and Roofing (American Society Testing Materials Proceedings, 25 (1925), pt. 1, pp. 776-785, fig. 1).—These methods cover the examination of felted or woven fabrics saturated (but not coated) with asphalt or coal-tar products, for use in the membrane system of waterproofing and roofing.

Fire Curing Tobacco Barns, (Rhodesia Agricultural Journal, 23 (1926), No. 1, pp. 33-36, pl. 1).—Drawings, specifications, and a bill of materials for fire curing tobacco barns for use under Rhodesian conditions are presented.

The Construction of a Laying House for Poultry (Northern Ireland Minister of Agriculture Leaflet 28 (1926), pp. 6, pl. 1).—Information, drawings, and a bill of material for use in the construction of a laying house for poultry to meet conditions in northern Ireland are presented.

Cheese Factory and Creamery Plans With Specifications (Canada Department Agriculture Bulletin 47, n. ser. (1925), pp. 35, figs. 9).—Drawings and specifications for creameries and cheese factories, with special reference to Canadian conditions, are presented.

Wind Motors: Function of Counterweights Applied to the Pump Rod (Rev. Facult. Agron. La Plata, 3. ser., 15 (1923), No. 2, pp. 66-82 figs. 11).—A mathematical analysis of the functions of counterweights attached to the pump rod of a windmill-driven pump is presented. According to this analysis counterweights facilitate the movement of elevation of the motor as well as compensate for the weight of the pump rod. They are considered to be especially important for deep well pumps, and promote uniform and regular movement, reduce vibration, and lengthen the life of the motor.

Construction of Heavy Concrete Rollers, H. Akerberg (Svenska Mosskulturfor. Tidskr., 39 (1925), No. 5-6, pp. 338-351, figs. 9).—Information on the construction and use of different kinds of concrete rollers and on their action on the soil is presented. Detailed drawings of different types and of the forms for use in their construction are included.

Milk Houses for California Dairies, H. L. Belton and J. D. Long (California Station Plan Ser. A, Nos. 1, pp. 11, figs. 7; 2, pp. 11, figs. 7; 3, pp. 14, figs. 9; 4, pp. 11, figs. 5; 5, pp. 14, figs. 12).—Plans, specifications, and bills of material for structures listed in Circular 286 of the station (Agricultural Engineering, 7 (1926), p. 25) are presented. No. 1 deals with small milk houses for cream production from small dairy herds, No. 2 with a 8 by 16 foot milk house for milk or cream, No. 3 with a 10 by 16 foot general purpose milk house, No. 4 with 12 by 18 foot milk house for medium sized dairies, and No. 5 with a 20 by 32 foot milk house for large dairies.

The Use of Sulphur in Rendering Cement Drain Tile Resistant to the Attack of Alkali, P. H. Bates (Industrial and Engineering Chemistry, 18 (1926), No. 3, pp. 309, 310).—Studies conducted at the U. S. Bureau of Standards are reported which showed that although the treatment of cement products such as draintile by impregnation with molten sulphur increases their strength very markedly and decreases their absorption, it does not in any manner increase their life in alkali soils.

First Progress Report on Soil Erosion Experiments, North Carolina Experiment Station Farm, West Raleigh, Wake County, North Carolina, F. O. Bartel (U. S. Department Agriculture, Bureau Public Roads, Division Agricultural Engineering, pp. [2]+21, pls. 5).—Experiments conducted by the North Carolina Experiment Station in cooperation with U. S. D. A. Bureau of Public Roads to determine the amount of run-off and soil eroded from plats of Cecil fine sandy loam soil of varying length and also from plats of equal length when growing different crops are reported. The installation consisted of seven plats each 6 feet in width and ranging from 37.5 to 200 feet in length. The slope averaged about 9 per cent and was quite uniform. At the foot of the plats are a series of tanks set in the ground with their tops approximately level with the surface at their upper sides. Each plat is inclosed by a tight fence set well into the ground, and the run-off from each plat is confined and caught in the corresponding tank. The crops planted on the different plats were cotton, grass, and corn, and in some cases the plats were cultivated but not planted.

The results indicated that run-off is apparently proportional to the intensity and the amount of rainfall rather than to amount alone. The average run-off was found to be 35 per cent of the rainfall, and the maximum for a single rain 64 per cent. Erosion seemed to follow the same principle to some extent, although the controlling factor in this case appeared to be cultivation. During June, July, and August when this was being practiced, the average percentage of run-off and erosion was 0.99. During the remainder of the year it was only 0.12 per cent.

The character of the vegetative covering on the soil was found to be the principal factor in controlling erosion. During June, when cultivation was carried on and before the crops had made material growth, 50 per cent of the annual erosion occurred. The rainfall during this month was 15 per cent of the total and the run-off 25 per cent.

Grass sod was found to be strikingly efficient in decreasing both run-off and erosion. Omitting the June record, the run-off from the grass plat was 27.5 per cent and the erosion 2.7 per cent as compared with the bare plat. Corn also showed a beneficial effect in both instances, while erosion was increased on cotton. The total run-off from cotton also showed an increase over that from the bare plat, although if the June record is omitted a decrease is shown.

The amount of run-off was found to decrease with increase in the length of the plat. Erosion was irregular in this respect.

The Utilization of Solar Light and Heat in the Treatment of Night Soil, M. E. Barnes (American Journal Hygiene, 5 (1925), No. 2, pp. 202-216).—Studies on the possibility of utilizing solar light and heat for the purification of night soil are reported. These showed that insulated boxes provided with tight fitting, double layered glass covers are an effective means of concentrating heat derived from the sun under conditions prevailing in Siam. It was found that the temperatures attained within such boxes under favorable conditions greatly exceeded the thermal death points of the ova and larvae of hookworms, and that the maximum temperatures obtained exceeded the thermal death points of all vegetative forms of ordinary bacteria. The utilization of solar light and heat by means of such boxes for the treatment of night soil in selected regions is therefore suggested.

Seasonal Variation in Salinity of Water of Some Drains of the First Circle of Irrigation, R. Aladjem (Egypt Minister of Agriculture, Technical and Scientific Service Bulletin 66 (1926), pp. 4, pls. 5).—The results of chemical analysis of drainage waters from irrigated soils are graphically presented, indicating the seasonal variations. The variations depend on the amount of water available in summer and, consequently, on the state of the river. The maximum salinity occurs in January during the time of clearance of the canals and when little or no water is available for irrigation. The drainage waters become more and more saline until water is again available. After February the salinity increases until July when the true natural maximum occurs. The actual maximum occurring in January is regarded as artificial. After July as the flood water arrives the amount of water available becomes greater, and the salinity of the drainage water is reduced to a minimum. The low salinity generally continues until the time of winter clearance.

It is noted that the curve for sodium chloride is almost parallel to that for total dissolved solids and forms from 40 to 90 per cent, the remainder being bicarbonates and bisulphates.

The conclusion is drawn that there can be little chance of using drainage water for the irrigation of crops when the Nile is low. However, it is thought that the waters of some drains may be usefully employed for the preliminary washing of salt land during the process of reclamation.

The Effect of Beet Pulp on Portland Cement Concrete and Mortar, O. V. Adams (Colorado Station [Bulletin] 306 (1925), pp. 3-14, figs. 6).—Studies are reported which showed that beet pulp had a destructive effect on both the mortar and concrete specimens used in laboratory tests. This action was not great up to 150 days of storage of the specimens in the beet pulp, but increased progressively for longer periods.

The results of tests and field observations showed that while there is no doubt that concrete and mortar are affected by beet pulp, it can not be said that the rutting and wear on the concrete pavement at Loveland, Colorado, over which beet pulp has been hauled since 1915, has been due to the action of pulp drippings alone.

In the laboratory tests the tension specimens stored in pulp for 153 days showed no appreciable reduction in strength, but did show a marked reduction after 383 and 709 days of storage. The average strength of tension specimens stored for 709 days in beet pulp was only 65 per cent of that of specimens stored in moist sand.

There was a slight reduction in the compressive strength of cylinders stored in pulp for 153 days as compared with that of cylinders stored in sand. The compressive strength after 383 days of storage increased over that for 153 days. There was a marked reduction in both the actual compressive strength and the compressive strength ratio of all series for 709 days of storage as compared with 383 days of storage.

The abrasion-loss ratio was always greater than one, and increased progressively as the storage time was increased. The pulp storage cubes were lighter at the end of all three storage periods than the sand storage specimens.

Studies of Bond Between Concrete and Steel, D. A. Abrams (American Society Testing Materials, 25 (1925), pt. 2, pp. 256-272, figs. 11).—Studies conducted at the Lewis Institute are reported which showed that the slipping of a steel bar embedded in concrete begins at a bond stress of from 10 to 15 per cent of the compressive strength of the concrete, but that considerable additional load is taken before the ultimate bond resistance is reached.

Bond and compressive strengths were found to increase with the age of the concrete from seven days to one year. The bond strength responded to changes in the water ratio of the concrete

in much the same way as the compressive strength. An increase in the water ratio due to the use of wetter concrete, less cement, or an excess of fine aggregate resulted in material reductions in both bond and compressive strengths. The bond strength decreased for mixtures richer than 1:1.

It is concluded that the use of 4 per cent of the 28-day compressive strength of concrete as the working stress in bond for plain bars is justified, and that this gives a factor of safety of from 2.5 to 3 against first slip.

The use of crude oil to replace mixing water in general caused a reduction in both bond and compressive strengths. Replacing cement with hydrated lime decreased the compressive and bond strengths about 1.2 per cent for each one per cent of hydrated lime in terms of volume of cement.

Machining Tractor Cylinder Sleeves (Machinery, 32 (1926), No. 8, pp. 628-631, figs. 11).—The operations performed in finishing cylinder sleeves for tractor engines are outlined and illustrated.

Agricultural Engineering Studies at the Indiana Station (Indiana Station Report 1925, pp. 37, 38).—It is stated that during a period of slightly over two years the wind-driven electric light plant has generated sufficient electricity for lighting the average farm home and for operating a small motor-driven appliance such as a vacuum cleaner. The generation was found to be greater during the winter and spring than during the summer and fall.

Field tests conducted during wheat and oats harvest verified the results of laboratory investigations of irregularities and imperfections of binder twine previously reported (Agricultural Engineering, 6 (1925), p. 310). Poor splices and loose fibrous places in the twine caused most of the difficulties. Twine which curled or kinked as it came from the ball caught on projections of the binder and caused the twine to break in some cases. Lack of uniformity in the thickness of the twine made accurate adjustment of the knotter impossible with some twine. Twines made of harsh fibers could not be tied in a tight knot, and frequently the end of the twine slipped out of the knot when the bundle was dropped upon the carriers.

Laboratory tests showed that carbide gas is a satisfactory source of heat for operating an incubator. A 1-cubic-foot burner approximately half open supplied sufficient heat and maintained a uniform temperature within a 120-egg incubator while the temperature of the room in which the incubator was operated varied from 54 to 92 degrees Fahrenheit. After the burner was adjusted it required practically no attention until hatching time.

Data on the relation of electricity to agriculture are also included.

Experimental Studies of Agricultural Hydraulics (Rev. Facult. Agron. La Plata, 3. ser., 15 (1923), No. 1, pp. 5-39, figs. 12).—Three series of studies are reported, the first of which dealt with the benefit of irrigation in general on alfalfa, Sudan grass, maize, and cane.

Flooding was found to be a more rational system of irrigation of alfalfa than the furrow system. This was especially true with alfalfa seeded in rows during dry seasons. Mulching between rows of Sudan grass after each cutting increased the yield. However, mulching apparently did not materially increase the effectiveness of irrigation. A single irrigation applied at the critical period was found to produce a greater crop of maize than either two or three irrigations.

The second series of studies dealt with subirrigation. This method produced a considerably larger crop of alfalfa than surface irrigation. The maximum distance apart for tile lines was found to be 1 meter (39.37 inches). Subirrigation increased the crop of sugar beets over that produced by surface irrigation and also increased the total yield of sugar. Bigger crops of onions and tomatoes were also produced by subirrigation, although the differences were not so great as with other crops.

The third series of studies dealt with the water requirements of certain crops, and data on the subject are presented. With alfalfa, for instance, increasing the total amount of irrigation increased the production of green material. However, the production of dry organic matter increased much more slowly as the amount of irrigation increased. The unit consumption of water increased markedly for each irrigation. This is taken to indicate that such utilization of water by the plant is not always an economical one.

It is concluded that the ideal solution of this problem consists in determining the economical limit beyond which additions of water produce no useful results. This will depend upon the year, soil, and climate, and under the conditions tested, the optimum was found to correspond to three irrigations.

Irrigation Investigations [at the Irrigation Substation], C. C. Wright (Washington College Station Bulletin 196 (1925), pp. 64-71, figs. 4).—Observations to compare water measurements on a stream passing over a 2-foot Cippoletti weir with measurements on the same stream recorded by a submerged orifice irrigation meter indicated that the meter is probably as accurate a measuring device as the weir. Data from duty of water experiments are briefly presented.

Studies of water relations of the soil in the field showed that the field water-holding capacity of the soil from 24 to 48 hours after irrigation was 2.77 inches per foot for the first foot, 3.52 inches for the second foot, and 3.27 inches for the third foot. The average loss of moisture per day from these plats was directly proportional to the amount of irrigation water added.

Fall irrigation experiments with alfalfa and corn showed that the yields from the alfalfa plats did not show noticeable increases or decreases due to fall irrigation. The corn plats, however, which were not irrigated in the fall and were irrigated in the spring before planting produced an average yield of 61.5 bushels per acre as against an average of 49.8 bushels per acre for the plats which were fall irrigated and not spring irrigated.

Data on the average ground water elevations in an experimental tract for each month during a period of three different years are graphically reported.

Experiments on the effects of drying the soil at a temperature of 105 degrees Centigrade on its electrical conductivity showed that differences in conductivity due to drying are well within the experimental error of the methods used for determination. A series of observations to determine the weight of a cubic foot of soil at different depths showed a wide discrepancy in the final weights due to the lack of refinement in the methods, but agreed in showing that the weight of the soil increases in the lower horizons.

The Draft of Farm Wagons as Affected by Height of Wheel and Width of Tire, J. C. Wooley and M. M. Jones (Missouri Station Bulletin 237 (1925), pp. 14, figs. 11).—The results of 629 tests of the draft of farm wagons as affected by height of wheel and width of tire are summarized.

These results indicate that increasing the width of tire from 1.5 to 4 inches was more effective in decreasing the draft than was increasing the height of wheel from 38 to 42 inches. Increasing the height of wheel or width of tire was found to become less effective as the density of the road surface was increased. There was very little difference in the draft of different kinds of wheel equipment on a concrete roadway. The advantage of wide tires was indicated in three conditions out of four, being negligible on pavement or hard, dry roads, but more pronounced for farm or field conditions. Six-inch tires caused a decrease in draft on all of the roadways tested, the draft decrease being greatest on plowed ground.

A mathematical analysis of the draft of a farm wagon is included, on the basis of which information on the selection of a farm wagon is presented. It is stated that 36-inch front and 40-inch rear wheels equipped with 4-inch tires appear to be the logical choice for a wagon to meet the needs of the average farm.

[Agricultural Engineering [Studies at the Missouri Station] (Missouri Station 236 (1926), pp. 28-33, fig. 1).—The progress results of studies at the station are reported (Agricultural Engineering, 6 (1925), p. 310).

In studies by J. C. Wooley and M. M. Jones of methods for prolonging the service of wood fence posts, a number of additional posts were set that had been given a 5-hour double tank butt treatment in creosote, and the tops painted with hot creosote. These posts are as yet all good except the soft maple posts, which failed after two years, and the sycamore posts, two of which failed after two years. Data on other posts are tabulated.

Experiments on the use of the sprout machine by Wooley, C. A. Helm, and A. J. McAdams showed that stumps should be cut low, so that they will not catch the frame of the machine and slow up the beater chains when the machine passes over them. The sprouts and brush should be cut clean when the timber is removed. The machine should be used the first year after the timber is removed, since second year growth is too large for the most effective use of the machine. Apparently two strippings per year are necessary.

Data from a continuation of experiments on the draft of wagons, by Wooley, are tabulated. It was found from tests in cultivated land that a saving in draft of 46.5 pounds per ton of load was accomplished by increasing the height of wheels from 38 to 42 inches, while an average reduction of 118.5 pounds in draft was obtained by using 4-inch tires in place of 1.5 inch tires. The high wheel, narrow tire wagon had about the same draft as the common low wheel, wide tire wagon. The convenience of the low wheel wagon is considered to indicate its desirability for farm use. Neither the height of wheel nor the width of tire had any marked effect on the draft on hard surface roads.

A continuation of the draft tests of plows by Jones and F. L. Duley showed that within a range of moisture conditions set for plowing there was a tendency for the draft to increase as the moisture content decreased.

Book Review

"History of Manual and Industrial Education Up to 1870," by Charles Alpheus Bennett, editor of Industrial Education Magazine, and formerly professor of manual arts of Bradley Polytechnic Institute, is a new book just published by The Manual Arts Press, Peoria, Illinois. As stated by the author, the preparation of this volume was undertaken on account of the difficulties encountered through many years in trying to help students build up in their own minds an adequate historical background of the present development in manual and industrial education, and because of this conviction that such a background is essential to an adequate understanding of the present day problems of public education. The book contains chapters on labor and learning before the Rennaisance, the relationship between things and thoughts, hand training a means of mental training, hand work a fundamental means in education, the Fellenberg Institution at Hofwyl, the followers of Pestalozzi and Fellenberg, industrial schools for delinquent children, development of school substitutes for apprenticeships, the mechanics institute movement, higher technical education in relation to instruction in the manual arts, and the development of art education in relation to industry. The book contains 450 pages of text matter and is well illustrated. The price is $3.50.

AGRICULTURAL ENGINEERING

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Contributions of interest and value, especially on new developments in the field of agricultural engineering, are invited for publication in this journal. Its columns are open for discussions on all phases of agricultural engineering. Communications on subjects of timely interest to agricultural engineers, or comments on the contents of this journal or the activities of the Society, are also welcome.

Original articles, papers, discussions, and reports may be reprinted from this publication, provided proper credit is given.

RAYMOND OLNEY, Editor

The Value of a Visualized Objective

AT THE Lake Tahoe annual meeting of the American Society of Agricultural Engineers retiring President F. A. Wirt took occasion to urge that each division in the Society select for the ensuing year a definite objective to constitute the major part of that division's interest and activity. In a manner of speaking the idea is to apply the project method to the work of the division.

In the case of the Farm Power and Machinery Division an effort was made not only to adopt such an objective but to express it as vividly and briefly as possible in a definite phrase. "More profit in farming through more power per worker" was proposed by F. N. G. Kranich. The discussion brought out the danger of this phrase being construed to mean only tractors or other mechanical power, and the objective was modified to read "More profits in farming by more efficient use of farm equipment," a phrasing which seemed to avoid all objections and which was adopted unanimously.

While it is obvious that usually each division will be pursuing several lines of effort simultaneously, and that no one of them can be adequately described in a brief and brilliant phrase, there nevertheless are substantial benefits promised by the proposal. For one thing it seems that the American people, including the membership of the Society, have a liking for slogans, and it is only a matter of engineering efficiency to take advantage of this. Within the divisions effort is likely to be better correlated and work done with more enthusiasm if it is directed toward a definite goal.

Perhaps even more important is the publicity aspect of the matter. The general public is neither qualified for nor interested in delving into the innumerable details and technicalities of the Society's work, but if the broad objective of the Society, or of a division, can be summed up in a pithy phrase public opinion will be able to grasp what in the vernacular is called the big idea. This should be of substantial assistance in getting publicity in newspapers and other lay publications, and also in enhancing the effectiveness of the publicity secured. During the discussion and adoption of the Farm Power and Machinery Divison's objective, it was suggested that it be printed on letterheads in red ink for use in division correspondence, and that in the preparation of radio talks and articles for publication the objective or slogan as formally adopted should be introduced rather freely and frequently in order that it should by repetition become well known to the public.

It seems proper to suggest, for the benefit of the divisions which have not yet agreed on a formally phrased objective, that an objective stated in slogan form can hardly be comprehensive or very accurate. It will be better to select some outstanding line of activity and visualize it in a few strong, homely, Anglo-Saxon words, and a word of caution may be added with respect to the danger of attempting to create a slogan by the processes of parliamentary discussion. The usual result is that when it has been whittled down to remove all objections, and modified and amplified to convey a precise meaning, it has lost those qualities of picturesqueness, virility, and brevity, which are the soul of such a phrase. Such a result may be likened unto a detailed drawing, whereas the thing desired is a striking poster.

An Agricultural Engineer Abroad

Secretary, A.S.A.E.

JUST dropping you a few lines as I know you have often asked us to do. I was too busy to write you about this trip before I left.

I attended the "World Power Conference" at Basel, Switzerland, from August 30 to September 8. There were thirty-eight countries represented at the meeting. I appeared on the platform at two different sessions to report on the use of electricity in agriculture. There were representatives from thirteen countries interested in this topic. The United States was represented by ten delegates but only five took part in the discussions.

Since the conference I have been visiting farms and studying the uses of electricity in Switzerland, France, Germany, and Sweden. I will take in Norway and England before I return.

Sweden is more like America than any other nation in continental Europe. I saw my first threshing machine in Europe with a straw blower on it this morning near Stockholm. France and Germany use very little machinery in agriculture. Sweden has about 50,000 threshing machines driven by electric motors. This is the most important application of electricity to farm work. I saw one motor yesterday, in operation on a threshing job, that is now over twenty-four years old. This machine still had the original carbon brushes in use. Not a single repair had ever been made on it.

E. A. STEWART

Stockholm, Sweden.

Does It Pay?

A stranger came into my office.
He wore his Society emblem
Where I could see it.
We were strangers no longer.

He had traveled twenty-eight days
On a passenger steamer
From his home
To the United States.

We discussed agricultural engineering
And soon found
We have many mutual acquaintances,
All members of the A.S.A.E.

He was on his way
To other states
To spend two years
In graduate study.

He selected the schools
Not for their equipment
But because of their men
Who are active in the A.S.A.E.

IT PAYS!

L. J. FLETCHER

A. S. A. E. and Allied Activities

Standards to Be Set for Quality of Zinc Coating

UNDER the general auspices of the American Engineering Standards Committee, the American Society of Testing Materials has organized a committee, of which J. A. Capp, of the General Electric Company is chairman and S. S. Tuthill, of the American Zinc Institute is secretary for standardizing the quality of zinc coatings for iron and steel products. The membership is broadly representative, comprising accredited delegates from thirty-seven organization, among them the American Society of Agricultural Engineers which is represented by Channing Turner, of the U. S. Wind Engine & Pump Company.

There have been formed six technical subcommittes to deal respectively with hardware and fastenings; sheets and sheet products; plates, bars, structural shapes and their products; pipes, conduits, and their fittings; wire and wire products; and methods of testing. A seventh subcommittee on marine hardware and ship fittings is contemplated. All types of zinc coating, including the spray process, hot dip, electrogalvanizing, sherardizing, electroplating, etc., are embraced in the scope of the committee's work.

Interest of the agricultural-engineering profession in this subject is indicated by the extensive outdoor use of ferrous metal for wire fencing, steel posts, sheet metal roofs and structures, irrigation flumes, and many items of farmstead equipment, the life and annual cost of which are determined by the effectiveness of zinc coatings in resisting corrosion.

Research Associates at the Bureau of Standards

THE Bureau of Standards of the U. S. Department of Commerce just issued Circular No. 296, entitled "Research Associates at the Bureau of Standards," for the purpose of acquainting interested persons and organizations with the plan for cooperative research worked out at the Bureau of Standards. The circular is designed to enable organizations to conduct specific researches on important problems affecting their industry or specialty and it gives a brief history of the origin and present status of the research associate plan which has recently grown notably both in magnitude and variety of field. The Bureau by this plan supplements the facilities of organizations conducting research and affords facilities for those who have none. It makes research possible for any organization by loaning equipment, providing quarters, and affording facilities, data, and supervision, giving to qualified workers training and experience in research under bureau officers and cooperation. The research at present in progress ranges from fundamental science to the most practical applications in industry. The circular includes a list of the associates with the names or organizations and the problems under the investigation.

A Good Beginning

SIX freshmen, three sophomores and one junior are enrolled in the new professional course in agricultural engineering at the University of California. Prof. L. J. Fletcher, head of the agricultural engineering division, is quite pleased with this showing since this is the first year that this work has been offered in California.

There are four students engaged in taking graduate work in agricultural engineering, three working for a master's degree and one applying agricultural engineering as a minor towards a doctor's degree.

Windmill Generation of Electricity

THE Institute of Agricultural Engineering at the University of Oxford, of which Capt. B. J. Owen (Mem. A.S.A.E.) is director, has just issued, as Bulletin No. 1, a treatise, entitled "A Report of the Use of Windmills for the Generation of Electricity." This is rather an exhaustive treatise of the investigations which were originally undertaken by the research branch of the British Ministry of Agriculture and carried on at the Harpenden Windmill Experiment Station of the Institute of Agricultural Engineering. Copies of the book may be secured from the Oxford University Press, American Branch, New York City, and the price is 85 cents per copy.

A. I. E. E. Meetings

THE American Institute of Electrical Engineers has made announcement of its schedule of national and regional meetings. The national conventions consist of a winter convention which will be held in New York City, February 7 to 10, 1927, and summer convention to be held in Detroit June 20 to 24, 1927. Of the regional meetings, the New York City district will hold a meetng in New York, November 11 and 12, 1926; the Southwest district, Kansas City, February 14 and 15, 1927; Middle Eastern district, Bethlehem, Pennsylvania, April 14 to 16, 1927; and North Eastern district at Pittsfield, Massachusetts, or vicinity, May 25 to 27, 1927.

In addition to these meetings there will be numerous local meetings held by the sections and student branches of the institute throughout the country.

A.S.A.E. Meetings

AS THIS issue of AGRICULTURAL ENGINEERING is going to press the meetings of the Southwest and North Atlantic Sections have been held, and the report of these meetings will appear in the November issue.

The next important meeting to be held is that of the Farm Power and Machinery Division which will be held at the Hotel Sherman, Chicago, December 1 and 2. The second day of this meeting will be devoted to the agricultural application of the tractor and will be in the nature of a cooperative meeting with the Society of Automotive Engineers, which society will present a program on December 3, to be devoted to the internal-combustion engine phases of the tractor and also to the industrial application of the tractor.

Perhaps the most outstanding feature of the program of this meeting to be presented by the Farm Power and Machinery Division is that devoted to the combine. This part of the program will include such topics as the spread of the combine, field tests on the combine by engineers of the U.S.D.A. division of agricultural engineering, and field tests on the combine in Illinois, Wisconsin, and Pennsylvania, to be presented by agricultural engineers from those states. The subject of power take-off for the combine will also be discussed, as will also grain-drying experiments in connection with the use of the combine.

A subject of unusual interest to the farm-equipment industry—research in farm machinery—will be presented by J. B. Davidson, professor of agricultural engineering, Iowa State College, and will be based on the survey of research in this field which he has been conducting during the past year for the U. S. Department of Agriculture.

Late developments in corn borer control will be presented by C. O. Reed, professor of agricultural engineering, Ohio State University. Included in this part of the program also will be presented reports on the progress being made in corn borer control in other states. Col. O. B. Zimmerman, of the International Harvester Company, will lead discussion on the subject to corn borer control machinery.

One of the subjects of particular interest to the industry, that has been scheduled for the tractor program on December 2, is that of the trend in farm tractor design. The views of a number of outstanding engineers in the tractor industry will be presented, and it is anticipated that the subject will stimulate considerable discussion.

Timken Issues Engineering Data

THE new Timken engineering journal, a loose-leaf book of 110 pages contains technical information relative to the application of Timken bearings to automotive and industrial machinery. A number of pages are devoted to the explanation of the Timken bearing as manufactured at the present time. Such features as the positive alignment of the rolls, one-piece precision cage and special alloy steel are explained.

Typical problems, with the solutions, involving the calculation of various loads and the selection of suitable bearings are given. Tables showing bearing ratings, capacities and dimensions as well as speed capacity-curves are included.

Methods of mounting Timken bearings, shaft and housing design, adjustment of Timken bearings, closures, cup and cone fitting practices, assembly methods and lubrication are treated in separate chapters.

A full set of dimension sheets accurately drawn to scale, together with formulas and recommendations for the application of Timken bearings, developed through experience gained in successfully applying more than 150,000,000 bearings comprise another section.

Automotive and industrial engineers will find this journal a worthwhile reference volume for their technical library. Copies may be had by writing The Timken Bearing Company at Canton, Ohio.

Personals of A.S.A.E. Members

T. E. Hienton, project leader in rural electrification, Purdue University Experiment Station, is joint author with Kathryn McMahon, of Circular No. 134, entitled "Turn the Switch—Let Electricity Do the Work," that has just been issued.

M. M. Jones is on sabbatical leave from his work as associate professor of agricultural engineering at the University of Missouri and is doing graduate work at Iowa State College.

George W. Kable, agricultural engineer, Oregon Agricultural Experiment Station, is designated as author of the 1926 annual report of the Oregon Committee on the Relation of Electricity to Agriculture. Copy should be in the files of those who are interested in this particular subject.

H. E. Murdock, head of the department of agricultural engineering, University of Montana, is on a year's sabbatical leave and is doing work at the University of California on the economics of irrigation and drainage.

G. F. Steigerwalt has resigned as engineer of the Perry Fuel & Cement Company, Missoula, Montana, to become agricultural engineer with the Chicago district of the Portland Cement Association, 33 W. Grand Ave., Chicago, Ill.

New A.S.A.E. Members

Lloyd N. Brown, field engineer, University of California; U. S. Department of Agriculture; California State Division of Water Rights. Mail address, c/o Colberg Motor Boats, Stockton, Cal.

Evans Curry Crow, field engineer, Portland Cement Association of Pittsburgh, Pa.; address, Box 520, Uniontown, Pa.

E. Courtland Eaton, irrigation engineer, State Department of Public Works of California, Sacramento, Cal.

Rush Hamilton, salesman, Standard Gas Engine Co., Oakland, Cal. Address, 1049 Harvard Road, Piedmont, Cal.

C. V. Waddington, engineer, Kansas Gas & Electric Co., Wichita, Kans. Mail: 518 S. Vine St., Wichita, Kans.

R. H. Wileman, assistant in agricultural engineering, Purdue University, Lafayette, Ind.

E. V. Willard, commissioner of drainage and waters, State of Minnesota, 202 Old Capitol Bldg., St. Paul, Minn.

Applicants for Membership

The following is a list of applicants for membership in the American Society of Agricultural Engineers received since the publication of the September issue of AGRICULTURAL ENGINEERING. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Pierre Blommers, manager of ventilator sales, H. H. Robertson Co., Pittsburgh, Pa.

Herman H. Garner, president, Vortox Manufacturing Co., Pomona, Cal.

Samuel Ray Gibbons, agricultural engineer, Alabama Power Company, Auburn, Alabama.

George W. Kelley, editor "Farmstead, Stock and Home," Minneapolis, Minn.

Employment Bulletin

This service, conducted by the American Society of Agricultural Engineers, appears regularly in each issue of AGRICULTURAL ENGINEERING. Members of the Society in good standing will be listed in the published notices of the "Men Available" section. Non-members as well as members, are privileged to use the "Positions Open" section. Copy for notices should be in the Secretary's hands by the 20th of the month preceding date of issue. The form of notice should be such that the initial words indicate the classification. No charge will be made for this service.

Men Available

AGRICULTURAL ENGINEER, married, age 29, 1922 graduate of Iowa State College in agricultural engineering, now assistant engineer in construction department of International Railways of Central America, desires position where permanent residence is possible, preferably experimental or production work, or management of reclamation project or large ranch. Ten years experience in general farming with power equipment, experimental and teaching work, and construction work. Can speak Spanish, also some French and German. MA-130.

WORKS MANAGER available. Seventeen years experience in the designing and manufacture of tractors, harvesting machines, and earth-working tools. Sales experience in United States, Canada, England, France, and Italy. Write for interview. MA-132.

AGRICULTURAL ENGINEER, graduate of University of Illinois, nine years teaching experience as assistant professor in one of the largest universities of the central west. Eleven years manufacturing experience with one of the large tractor and farm implement builders. Experienced in production, design, and management. Desires position preferably as extension agricultural engineer or experimental or production manager work. MA-133.

AGRICULTURAL ENGINEER, single, age 26, graduate of University of Nebraska, College of Agriculture, with two years' practical experience in advertising and sales work, would like position in similar work preferably in South or Central America. Very good at drafting, designing, and photography of farm implements. Can speak a little Spanish. Has had a few articles published. Would submit samples of work. MA-134.

AGRICULTURAL ENGINEER, 1917 graduate Iowa State College, ten years' experience in highway; city; drainage; irrigation; concrete products; and concrete construction work. Available for immediate employment. MA-135.

Positions Open

AGRICULTURAL ENGINEER wanted to fill position at Preston, Cuba. Knowledge of Spanish desirable but not absolutely necessary. Farm experience, knowledge of gas and steam engines, and such machinery as ordinarily used on large sized farms is essential. Salary $150.00 to $175.00 per month, according to experience. Single man preferred. PO-116.

AGRICULTURAL ENGINEER wanted to divide his time between teaching and investigational work. He will handle instruction work in farm machinery and a research problem in rural electrification. The position to be filled by January 1927. Good salary for experienced man. Write C. E. Seitz, department of agricultural engineering, Virginia Polytechnic Institute, Blacksburg, Virginia.

DRAFTSMAN wanted by Midwest manufacturing concern with experience in planning dairy barns, hog and poultry houses. Write fully stating years of experience, previous employment, age, salary expected, and other details of interest. PO-118.

DESIGNING ENGINEER wanted by a large machinery manufacturer, contemplating the development of a combined harvester-thresher. A high-class designer with extensive experience is desired. PO-119.